19 SEPTEMBER 1958

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Two heads are more reliable than one.
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has two Armstrong-Siddeley Sapphires
and crew of two. This fact, together
with some remarkable radar equipment,
is one of many reasons for the success
this all-weather fighter has scored
in all kinds of conditions, with the R.A.F.

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Design, research, manufacture—Rotax provides complete facilities for them all. Rotax, in fact, has *all* the equipment, *all* the personnel to give you *all* the answers on everything from minute components to complete systems. If you're interested in the field of pneumatics, why not make use of the industry's most complete service by contacting Rotax.

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on the right views of : Test Rooms
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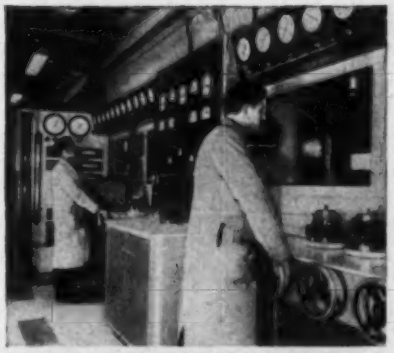
Compressor House.

For full details of our facilities available for your use, please write or phone Rotax.



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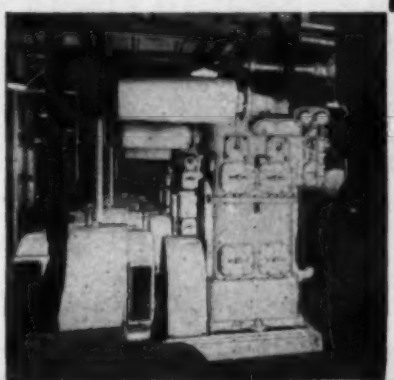


A

USERS OF PRATT & WHITNEY ENGINES PROFIT

SERVICE AROUND THE WORLD, wherever aircraft are based or wherever they fly, is provided for owners and operators of Pratt & Whitney engines. Field service representatives on duty outside the United States last year served all the places indicated on the map above. They travelled 6½ million miles during 1957.

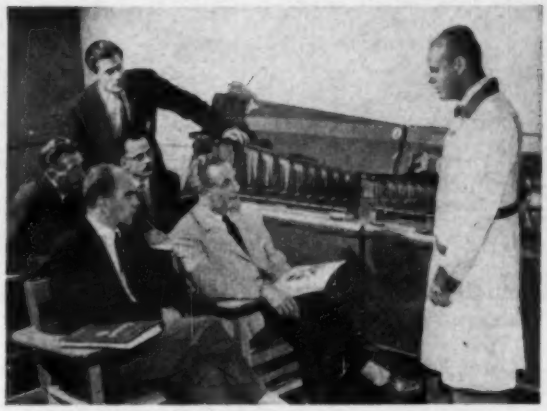
FROM THOROUGH CUSTOMER SUPPORT PROGRAM

Operators of Pratt & Whitney engines receive invaluable assistance from the broad and comprehensive customer support program conducted by Pratt & Whitney Aircraft around the world. The object of the program is to insure the dependable, efficient, and economical operation of Pratt & Whitney engines.

As an example, the world's largest staff of aircraft engine technical representatives serves operators of Pratt & Whitney engines on every continent. Three hundred highly trained engine experts provide authoritative, up-to-the-minute advice on maintenance, overhaul, spare parts, tools, and operations. To keep abreast of major technical advances, they return periodically to Pratt & Whitney in the United States for refresher courses and advanced training.

In addition, airlines and fleet operators are assisted by Pratt & Whitney airlines engineers. They act as operations consultants, offering guidance on operating techniques and engine performance. The airlines engineers often fly with the carrier's own crews to provide advice in the actual service environment.

In a large, modern service school near the Pratt & Whitney plants, courses are conducted for airline supervisory personnel and maintenance men, for representatives of airframe companies, and for the military. Now in its 20th year, this school has trained more than 15,000 men, including representatives from airlines all over the world. Current courses include jet engine familiarization for management and supervisory personnel, planning courses for managers of overhaul and maintenance, and courses covering specific overhaul and maintenance procedures. About 600 airline representatives are scheduled for jet engine courses during 1958 and 1959. Pratt & Whitney's superior customer service will, of course, continue with the coming of commercial jet aviation . . . as the world's leading airlines begin to fly their Pratt & Whitney powered Boeing and Douglas jet liners.



THOROUGH TRAINING is given to customer personnel. Factory experts teach engine theory, operation, and maintenance and overhaul in a modern school in Connecticut. Shown here, representatives of Qantas, SAS, and Air France study the Pratt & Whitney JT3 jet engine, which will power many of the Boeing 707 and Douglas DC-8 jet liners soon to enter service.

AIRLINES ENGINEERS provide special services for fleet and airline owners of Pratt & Whitney engines, advising on engine operation techniques and engine performance. The airlines engineers often fly with airline crews to offer guidance in the actual flight environment.

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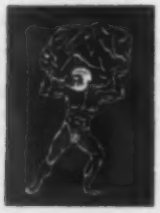
1. The C-130 HERCULES can carry 90% of all known missiles in use today. It flies missile cargoes, support equipment, and personnel 3400 nautical miles non-stop to launching sites.

2. Fuel from 6000-gallon auxiliary tanks inside the HERCULES' cargo compartment is pumped through wing-attached hose-reels and drogues—to fuel-hungry jet fighters.



Only one jet-age transport can

5. A palletized load of 35,000 pounds of cargo can be winched in or out of the HERCULES in only 40 seconds—cutting normal loading/unloading time from 3 hours to *15 minutes!*

THE LOCKHEED C-130 HERCULES has been rewriting the record books ever since it entered service for the United States Air Force in December, 1956.

62 tons big, 6 miles-a-minute fast, this versatile prop-jet sky giant has made front-page news across the world with its feats of speed, strength, endurance and versatility—a few of which are described at right.

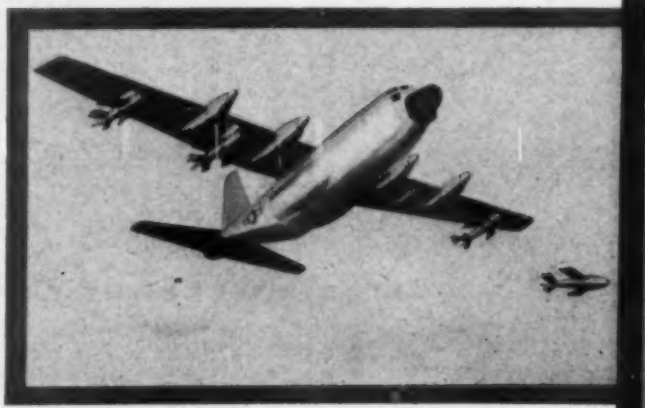
Designed and built by Lockheed, the powerful HERCULES is the unchallenged champion of the U. S. Airlift. No other airplane can do so many cargo and personnel hauling jobs so well, so fast and so economically.

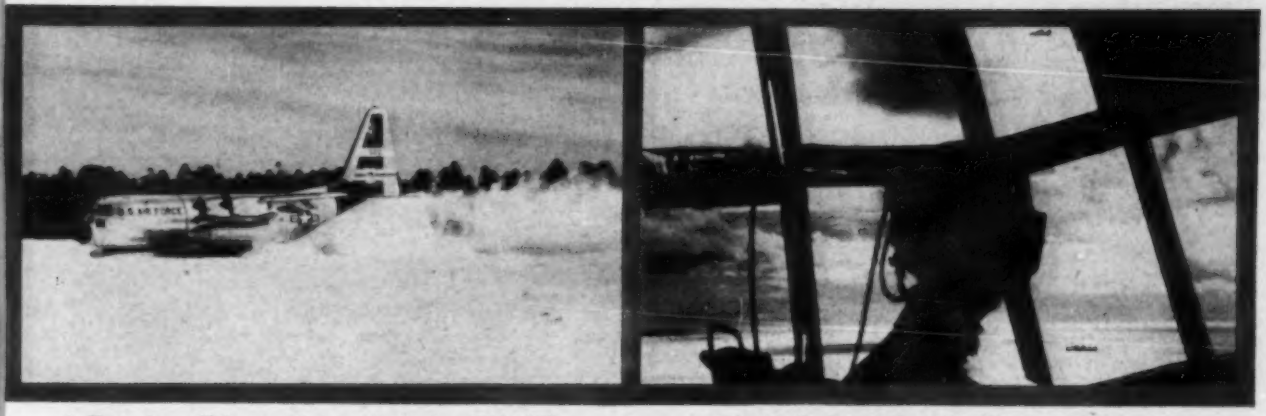
Airmen who know will tell you the HERCULES is well named. And that in 18 months its name has been well earned—world-wide.

8. "Universal drone launcher" version of versatile HERCULES will carry drones under wing, launch them to afford target practice for high-speed missiles.

Lockheed Aircraft Corporation
GEORGIA DIVISION, *Marietta, Georgia/USA*

LOCKHEED
means leadership





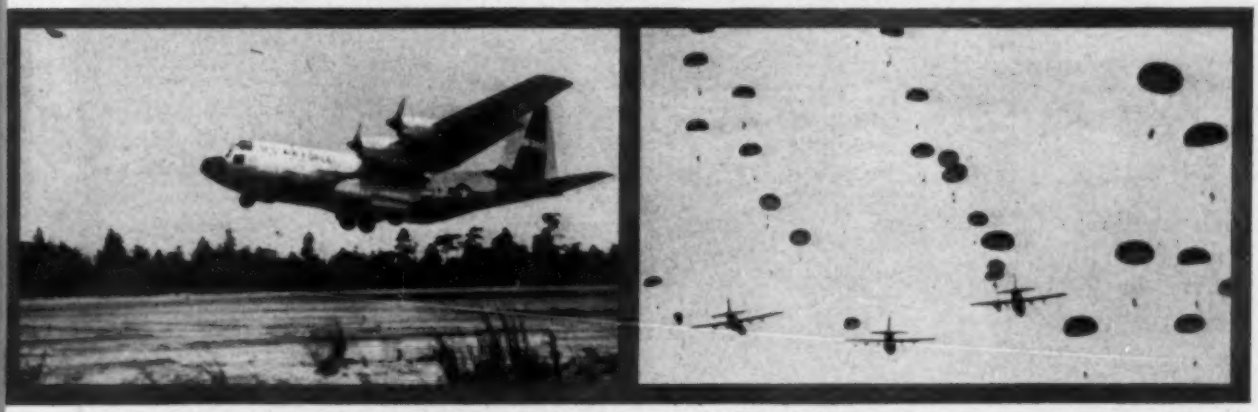
3. Zooming off from a frozen lake bed, a "Ski-130" breaks all records. Weighing 62 tons gross, it was airborne in only 2 100 feet; landed and stopped in 1,200 feet.

4. The U. S. Coast Guard will use HERCULES for long-range search and rescue operations. For extreme fuel economy, it flies easily on half power, has crossed country on only two engines.

perform all these FEATS OF HERCULES

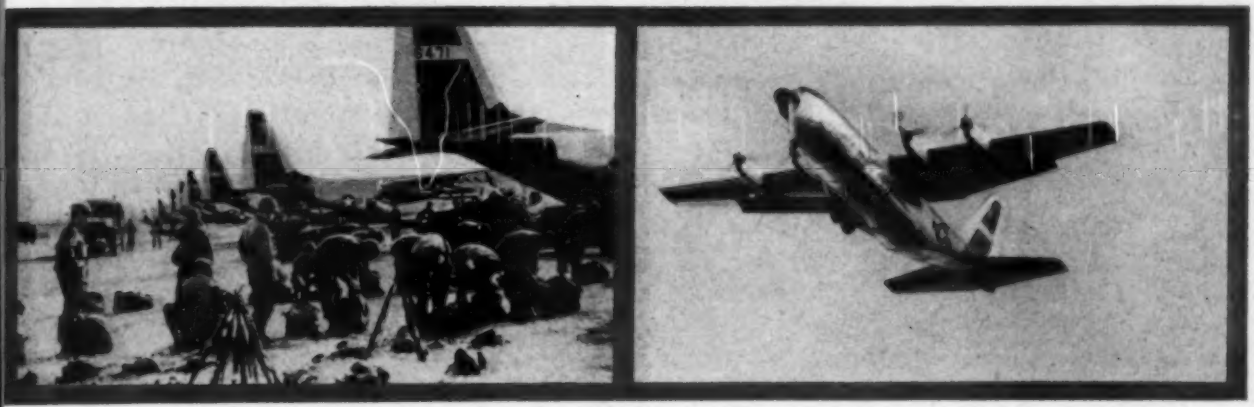
6. At Eglin Air Force Base, Florida, the C-130 HERCULES (weighing 110,000 pounds) landed on sand and stopped in 947 feet. Take-off from sand, with same load, averaged only 1500 feet.

7. From each HERCULES, 64 combat-ready paratroops bail out in seconds. C-130 also paradrops massive combat equipment. It holds record for heaviest chute-extracted drop: 30,370 lbs.



9. After a recent command decision a HERCULES airlift started moving 500 troops and 210,000 pounds of gear from U. S. base to Puerto Rico immediately. *13 hours later, mission accomplished!*

10. Most versatile jet-age sky giant, the C-130 is operational with USAF's Tactical Air Command . . . will soon serve Coast Guard, Marine Corps and the Royal Australian Air Force.



REPORT ON TRAFFIC PATTERN AND GROUND HANDLING

THE PRODUCTION BOEING 707, as demonstrated by 4 years of test-flying of the prototype model, operates with ease in existing traffic patterns of commercial airports. Though it cruises at 600 mph, the Boeing jetliner's manoeuvring speeds and airspace requirements for holding and instrument approaches are the same as those of today's conventional airliners.

GROUND-HANDLING poses no problems. For ground-handling and taxi characteristics of the 707—and of its shorter-range sister ship, the 720—are equal to and, in some cases, better than those of present-day commercial transports.

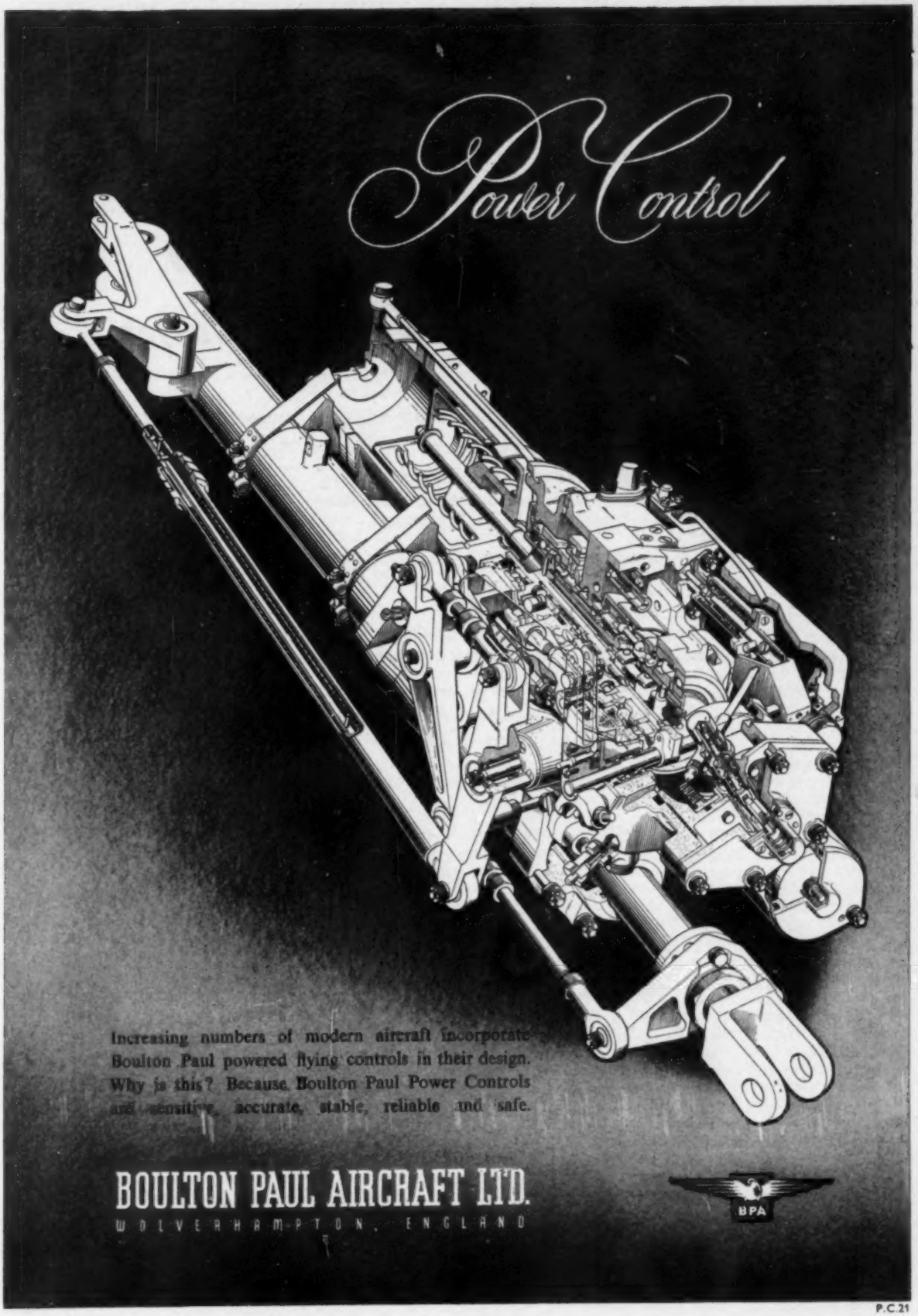
MANUALLY OPERATED flight control systems, proved out in hundreds of Boeing jet aircraft, give outstanding control and small airplane "feel" throughout all flight conditions. In rate of descent, the 707 and 720 offer greater flexibility than present airliners.

SPOILERS ACT AS AIRBRAKES, give added control over rate of descent. In all areas of operation, the Boeing 707 and 720 benefit from the unequalled experience Boeing gained building more than 1600 large, multi-engine jet aircraft.

BOEING

Family of jet airliners

These airlines have ordered Boeing 707 or 720 jetliners: AIR FRANCE • AIR INDIA • AMERICAN B.O.A.C. • BRANIFF • CONTINENTAL • CUBANA • LUFTHANSA • PAN AMERICAN • QANTAS • SABENA • SOUTH AFRICAN • TWA • UNITED • VARIG • *Also* MATS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ROLLS-ROYCE DEVELOPMENTS

Power growth of the Dart prop-jet

Dart prop-jets of 2,100 t.e.h.p. now being delivered, compared with the first production engines supplied in 1952, give—

36% more power for take-off
12% lower specific fuel consumption
12% higher power/weight ratio

During the five years since it entered airline service the overhaul life of the Dart has been raised as far as 2,000 hours.

Dart engines of 2,660 t.e.h.p. for delivery in 1960 will show the following improvements over the first production engines—

73% more power for take-off
15% lower specific fuel consumption
36% higher power/weight ratio

Work is in progress on versions of the Dart at higher powers and lower fuel consumptions, and a 25-hour test has already been successfully completed at a rating of 3,200 s.h.p. for take-off.

—another technical advance in

ROLLS-ROYCE

GAS TURBINES

ROLLS-ROYCE LIMITED, DERBY, ENGLAND

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FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

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The Man Apart

OURS is the age of the forum, the consortium, the symposium, the colloquium. Weightily documented bodies with a supposed common interest or problem convene on the merest pretext. There is diffuse talk about drafting blueprints, setting up frameworks and cross-fertilizing ideas; yet it is much in doubt if the precious young shoots of ideas can ever really thrive in the smothering atmosphere of a committee. The true idea—that rarest of blooms—is implanted in the brain of a solitary man, and flourishes not in the closeness of collaboration, but in the keen air of competition. How often is the cult of the assembly seen as a symbol of frustration—the collusion of barren brains in mutual reassurance. Often enough the setting-up of a study-group or panel leaves us unmoved; but any whisper that a new idea is being worked out in seclusion by a leader and his team brings a wholly pleasing reaction.

The man of ideas—the genius—is seldom a committee-man; nor is he so unworldly as to cast his bright new discoveries into the common pool. He is hard to find, though he moves among us still. In him lies our highest hope for the future. The groups can never displace him. At best they may be the means of serving him.

British Enlightened Airways

OF only a few airlines can it be truly said: "These are the pace-setters." Eminent stands the name of Pan American World Airways; and last week's visit to London of the first American jet airliner to touch down on European concrete was a reminder that it was PanAm who, inspired by B.O.A.C.'s Comet pioneering, caused the biggest airline re-equipment revolution in air transport history. The consequences of this revolution are now being most painfully felt in the airlines' balance sheets.

The international airlines, in agreeing to charge the same fares, may have avoided the political chaos which *laissez-faire* price-competition would have invited. But in standardizing their ticket prices the airlines have forced themselve into having to buy, willy-nilly, every new technical advance bought by the pace-setters for fear of losing business. The result is a rate of airliner-obsolescence which the industry cannot afford. This is the real cause of the airlines' financial malaise: rising costs and recessions are contributory factors, not the main ones.

Now a new pace-setter asserts itself. British European Airways have taken the lead in advocating a slowing-down of the pace. This airline states: "We believe that the whole air transport industry will continue to face the problem of inadequate profit margins until it recognizes that its rate of re-equipment should be slowed down." Having said this, B.E.A.—as foreshadowed on this page seven weeks ago—have decided to press for a jet *v* propeller fare-differential at the annual I.A.T.A. traffic conference which opens at Cannes next Tuesday.

It may seem surprising to some that an airline which has such a large investment in jets (six D.H. Comet 4Bs and 24 D.H.121s) should apparently want to put a surcharge on them. But this is the superficial, emotional view of the fare-differential. Its deeper significance lies in its being the means by which the whole air transport industry (not just B.E.A.) can save itself from being forced into re-equipping with every new technical advance. And, in fact, B.E.A. are not proposing a jet surcharge: their policy is to bring about a general lowering of fares (the first reduction, on U.K. domestic routes, was announced last week—see page 504), with turboprops offering lower fares than jets.

Thus will be established a class of air transport which, not being exposed to unbearably high costs of depreciation, can cut fares and penetrate into the mass travel market. And technology will be encouraged to flourish not only in the quest for more speed, for which there will always be a demand (only by jet can you fly home from Hong Kong in 18 hours, as did the Comet 4 this week). Technology will be able to flourish also in the sphere of low operating costs.

HOME TO HATFIELD comes the Comet 4 after its two-stop flight from Hongkong—7,925 miles in 18 hr 22 min (story on page 502).

FROM ALL QUARTERS

First Thor for the R.A.F.

EARLIER this week the first Thor I.R.B.M. for the R.A.F. was handed over by the U.S.A.F. and taken to the first British missile launching-site near Feltwell, Norfolk. It is reported that the 65ft-long Thor was flown to Lakenheath from the U.S.A.

The Feltwell site is operated by No. 77 Sqn., Bomber Command, commanded by G/C. F. A. Willan. A Ministry of Defence statement issued on August 25 confirmed that nuclear warheads for Thors would remain in possession of the American forces and would only be issued following joint agreements between the British and American Governments. Other Thor launching sites are to be set up at locations in East Anglia, Lincolnshire and Yorkshire.

A series of courses, both short and long, is being held at the R.A.F. Flying College, Manby, and the R.A.F. Technical College, Henlow, to teach R.A.F. personnel about the background, guidance and operation of missiles. Preparations are also under way for a longer course on surface-to-air guided weapons and their use in the defence system, while yet another course is being prepared for the Bomber Command I.R.B.M. squadrons.

"H.S." and the Brush Group

THE business of its subsidiary—the Brush Group—is to be integrated with that of the Hawker Siddeley Group, the parent company state. Sir Roy Dobson, managing director of Hawker Siddeley, comments: "This change was inevitable as part of the rationalization programme of the Hawker Siddeley Group. The Brush Group factories will, of course, continue energetically to operate and sell their own products under their own names." The board of the Brush Group has ceased to be an executive body, and all the directors, with the exception of Sir Roy Dobson, Mr. J. F. Robertson and Mr. P. C. Sharp, have resigned. Mr. Geoffrey C. R. Eley and Sir Harold Roxbee Cox have ceased to be directors of the Brush Group. Mr. Eley remains a director of the Hawker Siddeley Group. Mr. Ian T. Morrow has ceased to be managing director of the Brush Group and has left that company. Sir George Briggs has been given full executive responsibility for the operations of the diesel engine companies—Mirrlees Bickerton and Day, Ltd., The National Gas and Oil Engine Co., Ltd., J. and H. McLaren, Ltd., Petters, Ltd., and Bryce Berger, Ltd. Mr. Arthur H. Frampton, who is associated with A. V. Roe (Canada), Ltd., in an industrial consulting capacity, has been temporarily appointed with full executive responsibility for the electrical engineering companies, Brush Electrical Engineering Co., Ltd., and Fuller Electric, Ltd. Mr. D. S. A. E. Jessop (personnel director), Mr. C. F. Barnard (heavy engine division), Mr. Michael Clear (export sales), and Mr. J. Calderwood (technical director), although ceasing to be directors of the Brush Group, Ltd., will continue to act in their respective capacities. Mr. Maurice Tattersfield has also resigned his directorship, having accepted an outside appointment.

Alouettes for Evaluation

THE British Army was due last Tuesday to take over two Sud Alouette 2 helicopters for evaluation. The Army's interest arises from the ability of these turbine-powered helicopters to undertake communications and liaison work, artillery observation,

SALES AND EXPORT COMMITTEE of the S.B.A.C., at a pre-Farnborough gathering. L. to r. they are: H. J. Penrose, O.B.E. (Westland); G. W. Lacey, C.B.E. (British Aluminium); T. Simpson (H. M. Hobson); J. L. Thorne (Fairey); W/C. J. C. G. Bell (Sperry); E. S. Greenwood, O.B.E. (Gloster); T. C. Wallace (Alvis); Air Marshal Sir Colin Weedon, K.B.E., C.B. (Rolls-Royce); A. Cdre. H. M. Pearson, C.B.E. (Armstrong Siddeley); E. C. Bowyer, C.B.E. (S.B.A.C. director); H. W. Goodinge (S.B.A.C.); Dr. G. W. H. Gardner, C.B., C.B.E. (Director, R.A.E.); J. W. Adderley (English Electric); R. C. Handasyde (Vickers-Armstrongs); H. Buckingham (de Havilland Engines); D. P. Huddie (Rolls-Royce); F. E. N. St. Barbe (chairman of the committee); A.V-M. H. N. Thornton, C.B.E. (Blackburn); G. Anderson (Hawker); I. H. Brown (Hunting); P. P. Nelson Gracie (Folland); C. S. Emery (Armstrong Whitworth); D. G. Cockburn (S.B.A.C.); C. R. Burgess, M.B.E. (de Havilland Propellers); E. L. Beverley (English Electric); R. M. Hilary, M.B.E., T.D. (Napier); and F. Lloyd (de Havilland Aircraft).

THE SECOND MARK of Avro Vulcan—the B.2, with Bristol Olympus 200-series turbojets of 16,000 lb thrust each.

casualty evacuation and traffic control. The deal has been negotiated by Helicopter Sales, Ltd., British agents for Sud Aviation. Supervising delivery is Colonel Boris Deleque-Fourcaud, who served during the war with Nos. 611 and 341 Squadrons at Biggin Hill, and M. Irnould Schmit, who also flew with the Free French. Colonel Fourcaud will remain at Eastleigh to give initial training to Army pilots; the trials will take place in Britain and Germany. Four Army ground staff personnel are in France for instruction.

Battle of Britain Displays

FIVE R.A.F. aerobatic teams and one from the U.S.A.F. are to give performances during the afternoon of tomorrow, September 20, when thirty-four R.A.F. stations will be "at home" to the public in commemoration of the Battle of Britain.

Biggin Hill, which in the past has attracted the biggest crowd of the day, is due to have the Hunters of No. 111 Sqn. and the U.S.A.F. Skyblazers (F-100s) in its programme. This is also scheduled to include a parachute drop from 12,000ft (if weather conditions are suitable) by members of the British team who recently competed at the world championships in Czechoslovakia; a mock attack on a guided missile site; and a U.S.A.F. KB-50 flight-refuelling two F-100s and a B-66.

Mr. P. G. Lucas, G.M., F.R.Ae.S., who has been appointed assistant to the managing director of the de Havilland Aircraft Co., Ltd. His address in future will be c/o Saunders-Roe, Ltd., 45 Parliament Street, London, S.W.1, and he will be responsible for advising the managing director on current military and civil policy, for liaison with the Services, and for maintaining liaison with civil operators. He will act as sales adviser to Saunders-Roe.

Treble-One is also performing at its home base, Wattisham, and the U.S.A.F. Skyblazers at Horsham St. Faith. The other teams engaged are four Hunters of No. 56 Sqn., due to appear at Waterbeach and Gaydon (the latter station promising an ambitious display of V-bombers, both in the air and on the ground, in its elaborate programme); three Hunters from No. 229 O.C.U. at Chivenor, due to perform there and at St. Athan; and two Flying Training Command teams—the C.F.S. Jet Provosts (at Ternhill and Cosford) and Vampires from the R.A.F. College (at Cottesmore and Waddington). At Cottesmore some of the veteran aircraft of the Shuttleworth Trust will be on view.

A full list of R.A.F. stations "at home" on September 20 was given in *Flight* for August 8 (page 186).

In a Battle of Britain Week appeal, Air Marshal Sir Harold Lydford, council chairman of the Royal Air Forces Association, points out that the occasion provides an opportunity for everyone to acknowledge the debt voiced by Sir Winston Churchill in his famous words: "Never in the field of human conflict was so much owed by so many to so few."

Sir Harold continues: "Branches of the R.A.F.A. everywhere organize commemorative events, one of which is the Association's national Wings Day appeal, when emblems in the form of wings are sold to the general public. All monies derived from this appeal are devoted solely to welfare purposes and are kept entirely separate from the Association's administrative expenses."

New H.Q. for the Guild

A RECEPTION being held on October 2 by the Guild of Air Pilots and Air Navigators is likely to be the last the Guild will hold at Londonderry House, for by October 31 it will have moved into its new headquarters. These are at the R.A.F. Reserves Club, 14 South Street, London, W.1, where, by arrangement with the Club, the Guild will occupy the whole of the second floor. Freemen of the Guild will be able to make use of Club privileges and facilities for a modest subscription.

The Guild is holding its annual general meeting, at Apothecaries' Hall, London, E.C.4, on November 20.

Flight Refuelling Appointment

IT is announced that from September 8, W/C. H. C. Johnson has assumed the duties of commercial manager at Flight Refuelling, Ltd., taking over from Mr. Michael Cobham. Mr. Cobham will remain a director of the company and will continue to take an active interest in its affairs. W/C. Johnson has been with Flight Refuelling since its inception in 1934 and previously held the appointment of general services executive.

Sailplane Aerobatics

AN out-of-the-ordinary aviation event taking place this weekend —on Sunday, September 21, beginning at 10.30 a.m.—is the National Glider Aerobatic Contest organized by the British Gliding Association and London Gliding Club at Dunstable Downs. Some 17 exponents of the highly specialized art are competing, several of them in recently introduced sailplanes (such as the Slingsby Swallow and Olympia 419) which have been specially stressed for inverted flight.

Gliders will be released from aero-tows at 2,500ft and their pilots are required to complete four compulsory manœuvres before beginning their individual displays; each will finish with a spot landing. Public admission costs 1s per head.

IN BRIEF

This year's Commonwealth and Empire Lecture before the Royal Aeronautical Society, on October 9, is to be given by Mr. James C. Floyd, vice-president (engineering) of Avro Aircraft, Ltd., Toronto. His subject will be *Some Aspects of Canadian All-Weather Fighter Development.*

* * *

The first annual exhibition of business and private aircraft and cars is to be held in Chicago from October 24 to November 2. Both American and European manufacturers have been invited to participate. The sponsors are International Sports Car and Lightplanes Exhibitions Inc., 230 North Michigan Avenue, Chicago 1, Illinois.

* * *

The Royal Dutch Air Force, according to a report from Holland, is shortly to take delivery of 12 Fokker Friendships at a cost of 2,100,000 guilders each (about £200,000). Ten will be used as freight transports and the other two for passenger carrying. They will replace 20 Dakotas based at Ypenburg. It is also said that two Friendships, instead of one as originally announced, are being bought for the use of the Royal Family.

SPANISH CONFERENCE

The Congress of the Aeronautical Sciences in Madrid: Points from Notable Papers

The congress was held in the impressive setting of the Instituto Nacional de Previsión.

IT is hot at midday in Madrid, even in September. The streets quietly empty, the morning's bustle fades and for the siesta hours of the afternoon there is even sitting room on the few clanging trams.

Not until after lunch, at four o'clock, does the city reawaken to resume its normal business. The rule is all-embracing, and the delegates to the first International Congress of the Aeronautical Sciences, which took place in Spain's capital city last week, were glad to follow it. Sessions began at 9.30 in the morning, finished at 1.30 in the afternoon and were resumed at 4.30 p.m. in the pleasant cool of the day.

The Congress owes its existence largely to the inspiration of Dr. Theodore von Kármán, but also to funds donated by the Daniel and Florence Guggenheim foundation. At the opening session on Monday, September 8, Harry Guggenheim, the son of Daniel and Florence, and the man who now administers the fund, was able to introduce Dr. von Kármán to a gathering of the national associations of the world "devoted to the advancement of aeronautical and space sciences." Delegates were present from 23 countries, including an eight-strong team from Akademia Nauk, the Russian Academy of Sciences, which was led by its principal, Anatole Dorodnitsyne.

During the week some 46 papers were presented; a proportion of the deliveries overlapped, papers being read simultaneously in the Salon de Actos at the Instituto de Previsión, or at the Palacio de Communicaciones. A selection from those of more widespread interest are summarized here, and a 500-page volume of the proceedings will eventually be published.*

AERODYNAMICS

First lecture of the Congress was **Dr. von Kármán's** Daniel and Florence Guggenheim Memorial Paper on *Progress in Aerodynamics since 1946*. Twelve years ago supersonic aerodynamic knowledge was (in the lecturer's words) "a collection of mathematics and half-digested, isolated experimental results." Now, said Dr. von Kármán, some of our supersonic bombers have been designed on the basis of more detailed aerodynamic calculations than was possible in the case of the best supersonic aircraft.

Dr. von Kármán's paper was largely devoted to a discussion of the highlights of aerodynamic discovery: the simplification of flow problems in the hypersonic range and the complications due to shock and friction; the three disciplines of fluid mechanics, thermodynamics and chemistry, for which he suggested the term aerothermochemistry, and the theory of the electro-magnetic field. Thermonuclear reactions even led the way to "plasmadynamics."

The lecturer discussed the work of Evvard (U.S.), Krasilschikova (U.S.S.R.), Stewart and Büsemann on a wing with a subsonic leading edge, paying tribute to M. Roy's and MacAdams's work on delta wings; their method of assuming conical flow reduced the problem to a two-dimensional one that could be solved by means of Laplace's equation. R. T. Jones had shown that the drag of a symmetric flat wing is a minimum if the thickness is distributed so that drag per unit volume is equal for every element and Doris Cohen had shown that for triangular wings with subsonic edges, minimum drag is obtained by using negative spanwise camber—as in the Hustler.

Next, Dr. von Kármán discussed the theory of slender bodies and led on to an examination of interference effects between wing and body structures. He credited W. Hayes of CalTech with the theory that the resulting flow around the body structures in a low aspect ratio wing can be represented as originating from singularities distributed along the axis, i.e., area rule. (Here, Dr. von Kármán digressed from slender bodies to what he described as the typical sonic area-rule, or Marilyn Monroe, shape.) But, the lecturer reminded his audience, another class of favourable interference phenomena is possible by reflecting compression and expansion waves on components of a lifting system. He cited the Büsemann biplane and horizontal delta with a vertical wedge, where the pressure created on the wedge is transferred to the lower surface of the wing and the resulting L/D ratio is improved over a simple horizontal wing furnishing the same lift.

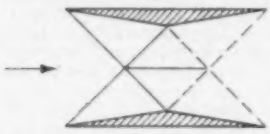


Fig. 1 (Von Kármán). Büsemann biplane, showing shock pattern.

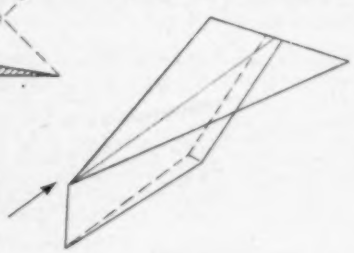


Fig. 2 (Von Kármán). Delta wing with wedge (arrows in both drawings indicate direction of airflow).

Finally, Dr. von Kármán discussed boundary layer ("which celebrated its fiftieth anniversary in 1954") and methods of its control. The laminar layer, he said, is doing quite nicely, but the theory of turbulent boundary layers at supersonic speed is not in a very good shape. "I understand that there is a new theory of turbulence (from Loitsianski) but I do not know anything about it." Dr. von Kármán closed with the words that mechanical, thermal and electromagnetic forces may be applied to propulsion. Aerodynamics cannot be put on the shelves as obsolescent although we may have to become familiar with many sister sciences.

The next paper on aerodynamics, following in the footsteps of the master, was **R. T. Jones's** *Aerodynamic Design for Supersonic Speeds*. This followed the Juan de la Cierva Memorial Lecture, read in Spanish. An English transcript was not available at the time of going to press. The phenomena of supersonic aerodynamics, said the lecturer, posed many problems for the designer. He was particularly interested in drag problems, while noting that studies which can cover an adequate range of geometrical form are at present limited to the linearized version of aerodynamic theory. It is not yet known, in practice, said Mr. Jones, how closely the good values of aerodynamic efficiency that theory

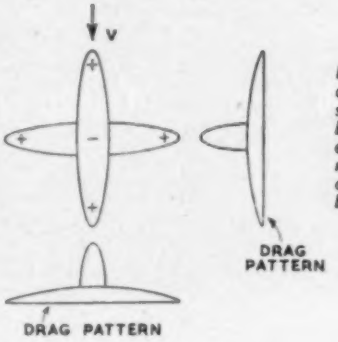
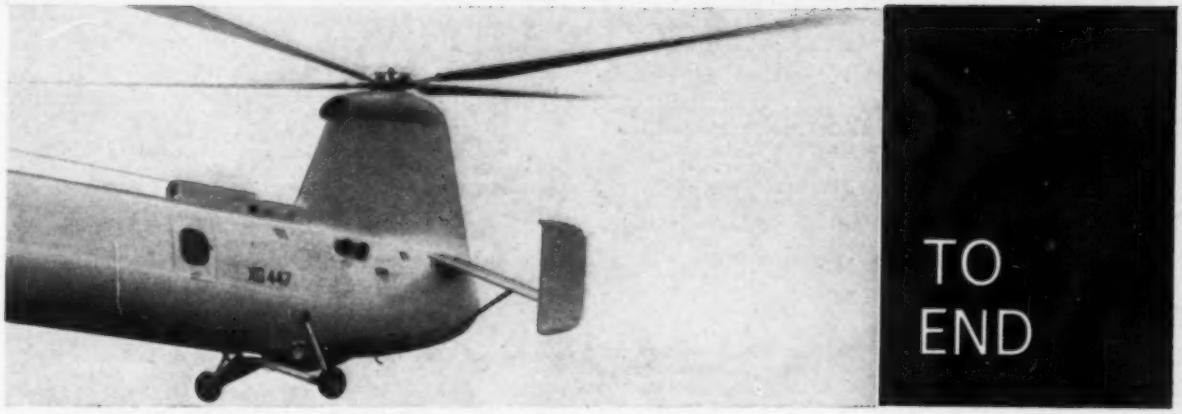
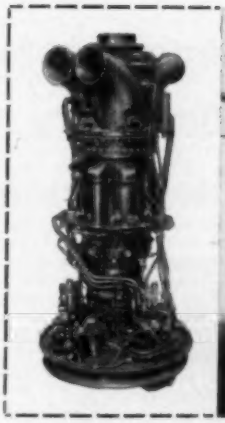


Fig. 3 (Jones). Minimum drag is obtained when a smooth distribution of lift between wing and fuselage can be obtained. Unless negative pressure in the centre of the fuselage can be arranged the drag pattern is as shown.

*Pergamon Press, Ltd., Pergamon House, 4 Fitzroy Square, London, W.1.



The Bristol 192 is one of the outstanding helicopters now in production. With two of the Napier Gazelle free turbine engines of 1,650 s.h.p. it is Europe's biggest military helicopter and has been ordered in substantial quantity for the Royal Air Force. Napier engines power a large proportion of the British civil and military helicopters in current production and development.



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indicates are possible may be achieved. Drag, for example, can be subdivided into component parts, although it must be remembered that interference drag at supersonic speeds will outweigh that of all the components. Using linearized theory, it is possible to divide drag into components of lift, by volume and by elements —but no division is fundamental and "you have to be on your guard." For the calculation of the drag of lifting surfaces, the study of reversed Mach waves had been very helpful.

Fig. 2 (Jones). An arched wing arrangement might be used to cancel wave drag by reflection of shock from the fuselage nose.

Discussing tests on a wing with 80 deg sweep at supersonic speeds, the lecturer remarked that it had seemed to him and to his co-researchers to be behaving like a subsonic aerofoil, so they substituted a Clark Y section as this was always a low-speed favourite; an L/D ratio of 9.0 was obtained. Next, two forms of obtaining minimum supersonic drag were proposed; a smooth distribution of lift between wing and fuselage, and the arched wing arrangement, where L/D ratios of 10 at M=1.5 and 6.0 at M=4 were possible. The Ames laboratory has done some useful work on Büsemann biplane tubes. Low drag values were obtained up to about five degrees angle of attack, after which the shock broke away from the tube.

GUIDANCE AND CONTROL

On September 10 were presented two important papers on operational flight. In the first of these, *Some Considerations of Safety in Automatic Flight Control*, **Capt. A. M. A. Majendie** said that automatic flight not only relieved the pilot of strain imposed by operational factors but made a contribution of its own by more elegant and precise control. Autopilot authority, however, must, to ensure safety, be weighed up against possible malfunction, although the compromise is an unhappy one. If an installation in some future aircraft meets all requirements for safety, it may be unacceptable in performance. Torque and "g" limiters bring problems of their own. Safety in the pitch axis is particularly difficult, as stick force/g and elevator angle/g are not constant throughout the flight regime; in the roll axis torque limitation of autopilot power is the obvious choice with V^2 feel and in the yaw axis it is fin strength which must primarily be taken into account in various yawed cases.

A new approach to the safety problem is due. Duplex autopilot installations or redundant multiplicity have been proposed, particularly for automatic landing, the most difficult safety problem of all; here the operator must face multiplicity or risk catastrophic runaway just before touchdown.

If duplication (by duplex sub-channels) is adopted, comparison of the two channels would give only manual control if one failed, and because twice as many components are used, the system would be only half as reliable. A triplex arrangement can however be adopted where inter-channel comparisons are possible and a high degree of safety is possible providing failure rate per channel is low and each sub-channel has the power to control the aircraft in its own right. But the only way (said Capt. Majendie) of ensuring safe automatic landing is to adopt a quadruplex arrangement with four sub-channels for each axis of control. "Only by this means can the probability of successfully accomplishing an automatic landing at the end of a flight be made sufficiently high, despite the risk of component failures en route."

The remainder of Capt Majendie's paper was devoted to a study of the statistical probability of failure (based on S.E.P. autopilots) for various systems, the conclusions being that a quadruplicated multiplex installation, with appropriate radio guidance, will be required for certificated automatic landing.

Following Capt. Majendie's paper came a joint lecture on *The Principles of Inertial Guidance*, by **C. S. Draper, W. Wrigley** and **R. B. Woodbury**, all of the instrumentation laboratory, Massachusetts Institute of Technology. Explaining elementary and fundamental navigation systems, the lecturers commented, "the line-of-sight observation difficulties that are associated with the use of celestial space to provide auxiliary reference co-ordinates for guidance purposes may be eliminated by the use of instrumentally established inertial reference co-ordinates." The principles of inertial guidance, say the authors, are identical with those of celestial body navigation, as an inertial co-ordinate system maintains a fixed orientation relative to the stars. The theory of inertial guidance is completely established but the practice depends upon the availability of quality gyro units and accelerometers, i.e., (1) Means for maintaining the orientation with respect to inertial space of the inertial reference package carried by a moving vehicle within tolerance limits and over time periods that are compatible with the requirements of the guidance problem to be solved; (2) Means for accurately indicating the local direction of

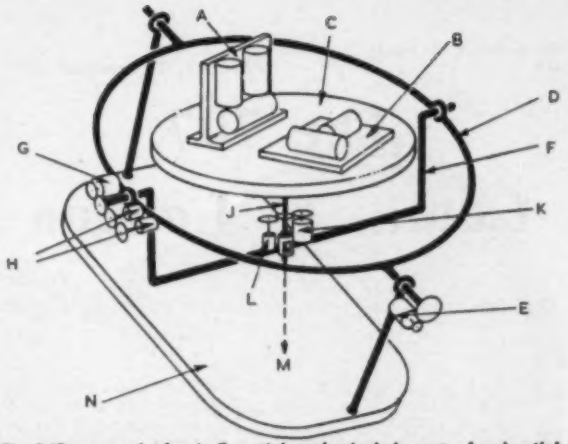


Fig. 1 (Draper and others). Essential mechanical elements of an inertial guidance system based on rotation of the inertial reference package with the indicated vertical. The base-motion isolation gimbal system consists of outer gimbal supports, outer gimbal, middle gimbal, inner gimbal, and associated drive motors and resolvers (electrical units, etc., necessary to complete the system not shown).

A, inertial reference package (three single-degree-of-freedom gyro units); B, specific force receiving package (two single-degree-of-freedom specific force receivers); C, controlled member; D, outer gimbal; E, outer gimbal drive motor; F, middle gimbal; G, middle gimbal drive motor; H, middle gimbal angle resolvers; J, inner gimbal; K, inner gimbal drive motor; L, inner gimbal angle resolver; M, indicated vertical; N, mechanical system base.

gravity within equipment subjected to erratic rotations, linear accelerations and gravitational components that accompany the operation of a moving vehicle.

The first requirement can be met by a servo-driven stabilization system (which was described later in the paper). The second special requirement is difficult to accomplish because of Einstein's principle of equivalence, but satisfactory indication of the local vertical may be achieved by designing the vertical-indicating subsystem to have proper dynamic characteristics. Mechanical ways

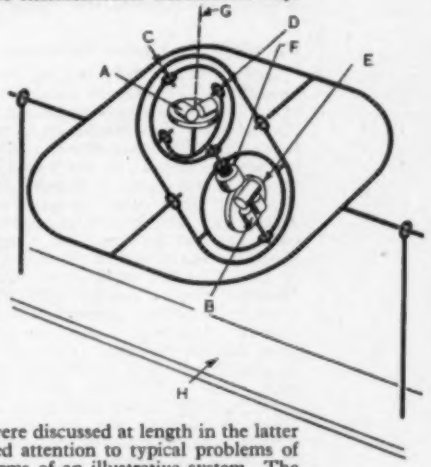


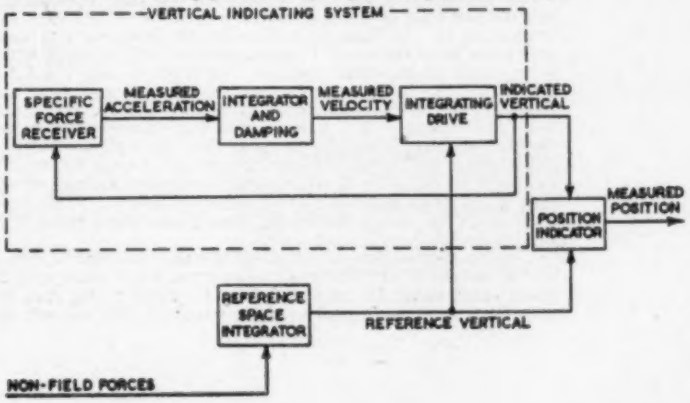
Fig. 2 (Draper and others). Schematic diagram of multiple-axis operation, showing use of a physically represented reference vertical aboard the vehicle to indicate position.

A, accelerometer package; B, gyro package; C, indicated polar axis; D, local east axis; E, Greenwich east axis (reference); F, sidereal time drive; G, indicated vertical; H, base.

in which this might be done were discussed at length in the latter half of the paper, which called attention to typical problems of sub-system performance in terms of an illustrative system. The authors conclude that what is now required is a development of applications rather than the introduction of new techniques.

(*Continued on page 486*)

Fig. 3 (Draper and others). Use of physically represented reference vertical. Non-field forces are transmitted through a space integrator to the vertical indicating position (only single-axis operation shown).



The 707 Comes to London

Impressions of the American Jet's British Debut

"IF there is any race it is not on our part. We will put this aircraft into service when our people know how to handle it. We are not going to operate one day sooner because of any so-called race." Mr. Harold Gray, executive vice-president of Pan American's Atlantic Division, said this at London Airport on Monday of last week. His audience—a large one—was the British press, and the aircraft under discussion was the Boeing 707.

This aircraft, the first representative of the airliner which is soon to revolutionize international air transport, was on the apron at L.A.P. Central, agreeably taxying round and round for the benefit of Ministry officials who were assessing with anemometers the effect of jet blast on apron equipment and parked aircraft. B.O.A.C. had kindly lent a 749 and a Comet 2E for these tests. Later in the day the aircraft was to fulfil the main purpose of its visit by taking off at 190,000 lb to permit the Ministry to confirm noise tests previously made at New York and Seattle.

One might have thought that the first visit to Europe of the first American jet airliner would have been an occasion for a little American-style pomp. Pan American World Airways' flair for promotion led one to anticipate a heavy salvo from the PanAm publicity guns when the first 707 came to England. Had not double-page-spread colour advertisements been proclaiming for weeks the "First and Fastest Jet across the Atlantic"? It was therefore a little surprising to find that PanAm's handling of the occasion was subdued and almost defensive.

Capabilities Under Restraint

One could not help feeling that PanAm would rather have brought the 707 over in circumstances less restrained. Because of the 190,000 lb weight restriction ("voluntarily" conceded to the Port of New York Authority to permit a steeper climbout and hence less disturbance of the community) the aircraft had to make at least one stop on its eastbound crossing. In fact it made two refuelling stops—one at Gander and another at Shannon. This can hardly have been the way PanAm, or Boeing, would have wished their new jet airliner to arrive for the first time in Europe, particularly in the month-old wake of the non-stop, full-payload Comet 4. But on the return trip to New York a fairer illustration of the 707-120's capabilities was provided. Taking off from Stansted Airport, Essex—where there is a 10,060ft runway and none of London Airport's noise-limitations—Pan American decided to attempt a non-stop crossing westbound, i.e., in the more difficult direction. Take-off weight was a little more than 237,000 lb, of which 103,000 lb-plus was fuel. Tankage was thus more than 12,500 Imp gal, total tankage of 707-120 being approximately 13,800 Imp gal. There were 29 passengers on board. The aircraft was observed to unstick after a take-off run of 8,500ft. The early part of the climb for the first two or three hundred yards was observed to be very shallow, but subsequently was considered to be relatively steep.

The impression gained during the 707's day at London Airport was that, with the announced date for the introduction of trans-atlantic services (November 1) only eight weeks away, a surprising number of doubts and uncertainties remain to be cleared up. Paramount are the matters of certification, noise and crew training.

Mr. Harold Gray said that certification was due "very soon," and the first fully certificated aircraft was due to be delivered on September 19. All Boeing's tests were completed, he said, and only paper-work remained. Questions were asked about reports of a suspected ground-stall condition. (A factor in the U.S.A.F. Boeing KC-135 jet transport-tanker take-off crash on June 27 is alleged to have been a ground-stall condition.) Could Mr. Gray deny these reports? "If I started out to deny all the stories about the 707's troubles it would take me all day," he replied. "I don't think I even want to start. I want the aircraft to speak for itself." But, someone asked, was it not true that Boeing were fitting leading edge flaps? This question was effectively answered: "The production 707 has always had leading edge flaps—take a look at the aircraft outside."

"Tex" Johnston, Boeing's chief of flight test, was asked a number of questions after the news conference, all of them with a ground-stall slant. He answered them all directly. He had, he said, been conducting heavy-weight, tail-down 707 take-offs at Seattle, with the tail-bumper six inches off the ground. "She went off every time with no trouble." What was the margin between stalling speed and unstick speed? Tex Johnston gave a figure of 25 knots, and in reply to a further question said that this was, and would remain, the margin. Did Boeing's figure of 9,600ft balanced take-off field-length for the 707-120 at full weight, sea level, standard conditions, still hold good? The answer was in the affirmative.

Subsequently a Boeing representative said to a small group of guests: "The 707 has never been subject to a ground stall, with or without leading edge flaps." Could this, the first positive denial of the alleged ground-stall, be attributed? "Yes, you can quote Jack Wadell, Boeing experimental test pilot."

Thus, if C.A.A. certification is in fact held up by an alleged ground-stall, it seems far from true that the 707-120, at the weights it will use and when handled correctly, is in trouble. It may happen that further aerodynamic modifications, perhaps more wing leading edge flaps, may be required. (When previously asked whether in fact any modifications had to be made before services could start, Mr. Harold Gray phrased his reply as follows: "There were 4,000 modifications required by the DC-3"). But there is no doubt that even if further modifications are in fact stipulated, there can be no underestimating Boeing's ability to fix them quickly and effectively.

The noise problem confronting the 707 is one of considerable complexity. The main concern of the Port of New York Authority and its acoustical advisers has been to ensure that the disturbance caused to communities beneath the take-off climb-out path is no greater than that caused by the heaviest piston-engine airliners—DC-7 and Super Constellation—which are judged to have reached the limit of reasonable noise. Unfortunately, because of the higher frequency of jet noise (1,200 c/s to 2,400 c/s, compared with 300 c/s to 600 c/s on piston engines), direct decibel comparisons are misleading. Furthermore, it is impossible to say whether or not communities will come, in time, to accept the jets' different kind of noise. A Boeing engineer was heard to suggest last Monday that but for all the publicity caused by the P.N.Y.A.'s attitude towards jet noise, the public would probably never have been hostile to it. This point of view was not shared by a senior Ministry engineer, who remarked that in his opinion jet noise was so unacceptable that night operations should not be permitted.

The Penalty Of Noise

However, as matters stand at present, the 707 is limited to 190,000 lb gross weight, so that height reached at a point three miles from the start of take-off is not less than 1,500ft. In these circumstances the 707's J57s, fitted with the 21-tube suppressors which are claimed to achieve a 12 db reduction in noise (6 db is "guaranteed"), are probably considered both by the P.N.Y.A. and the British Ministry to be acceptable during daylight hours. But obviously such a restriction, amounting to 57,000 lb of fuel and/or payload, would wipe out PanAm's hopes of being able to operate commercially competitive, not to mention economic, transatlantic jet schedules.

It seems doubtful whether the aircraft will be cleared for operation at max. permissible weight (which in any case cannot be the max. gross of 247,000 lb until Idlewild's main instrument runway is lengthened from its present 8,300ft to 11,200ft by next January). It would be realistic to expect that unless the P.N.Y.A. climb down to a considerable extent, the 707-120 will be severely handicapped as to range or payload when services begin, and perhaps also when the lengthened section of runway is available at New York. It remains to be seen whether the 707-320, which becomes available to PanAm next summer, will be able despite noise limitations to exploit its commercial capabilities to the full.

Crew-training, a subject which airlines always stress as good

(Concluded on page 505)

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VETERAN AT REST

Kingsford Smith's "Southern Cross" Installed in Memorial Hangar

NINE THOUSAND feet up in the cloudless Australian sky a light aircraft wrote the one word, *Smithy*, in letters of white smoke. Below, at Brisbane's Eagle Farm Airport, a turbojet liner screamed over the heads of a gathering crowd. A flight of Meteors flashed overhead in the five-star formation of the Southern Cross.

The fly-past was a tribute to another Southern Cross, the aircraft bearing that name, with which Sir Charles Kingsford Smith had made the first crossing of the Pacific Ocean 30 years earlier. Now, on August 17, 1958, the famous old Fokker F.VIIb-3m was being officially installed in its first permanent home. No more apt place could have been found for such a national memorial. Housed in an imposing structure of timber and glass, *Southern Cross* is now preserved only a few yards from where she touched down at the end of that triumphant 8,000-mile flight from Oakland, California.

Eagle Farm then had been little more than a dusty paddock. The only link between Australia and the United States was a three-week ocean voyage. Now that fast, comfortable airliners daily cover the same trans-Pacific route between San Francisco and Sydney, it is hard to imagine just how tough were those conditions Smithy and his three companions had to face. "This memorial is a tribute to the adventuring human spirit," said the R.A.A.F. senior chaplain, the Rev. L. J. Smith, during the dedication ceremony of the memorial. "It is given to few men to go out into the uncharted regions of human experience. When they do it is, in most cases, life itself that must be forfeit."

And so it was eventually with Kingsford Smith. Seven years after his conquest of the Pacific he and his companion, J. T. Pethybridge, vanished somewhere off the coast of Burma during a new attempt on the England - Australia record in a Lockheed Altair. A year earlier his co-pilot on the trans-Pacific flight, C. T. P. Ulm, had been lost some 500 miles north of Hawaii, while trying to repeat the achievement.

The old Fokker has outlived several of the men who flew with her. She now rests in a place where hundreds of travellers passing each day may be reminded of the hazards that accompanied those early feats of aviation.

During the Eagle Farm ceremony 23 years after Smithy's death many of the audience of 3,000 must have wondered how his sardonic spirit would have reacted to so much praise. The Federal Treasurer, Sir Arthur Fadden, had flown up from Canberra to unveil the memorial. Ironically, finance had been the one thing that eluded Kingsford Smith throughout the 38 years of his life. At the time he was planning his flight from Oakland he had no more than a few cents in the world. When he took off creditors were actually pushing through the crowd to have him arrested for debt. But for the generosity of several Californian backers he could never have flown the Pacific at all, nor even bought the well-tried *Southern Cross* which Australian-born Sir Hubert Wilkins had previously employed for his polar exploration flights.

The £20,000 subscribed by Government and private donors set up Kingsford Smith and Ulm for new adventures, and the *Southern Cross* began an even more exciting career. It is not surprising that the veteran aircraft has entered so deeply into the national consciousness. She has borne some of Australia's greatest pilots to victory and fame; she has outlived the terrors of cylone and thunderstorm, cut a trail through hitherto unknown skies and helped to lay the basis for the international air routes of today; she has carried large numbers of Australians on barnstorming flights throughout the country, when Smithy was earning a living in the only way open to him by joyrides and stunt flying. Thirty-five years old, with an extraordinary flying record and a tally of at least 70,000 passengers, the *Southern Cross* can well claim to be, as Sir Arthur Fadden expressed it, "one of the most famous aircraft in the world."

Specially invited to the ceremony, Harry Lyon and James Warner, the American navigator and wireless operator on the Pacific flight, renewed acquaintance with the veteran machine they had not seen for 30 years. They expressed amazement at her trim appearance, for she had been carefully restored, the wings painted silver and the fuselage blue.

A notable feature of the memorial was that two-thirds of the £30,000 required to build it came from two sources, the Fokker Company and the Atlantic Union Oil Co., Ltd., which supplied the petrol for the original flight. The architects, builders and contractors gave their services and materials free of charge. Features of the memorial are a scale model of the *Southern Cross*, a history of her flights and a world map marking them in precious stones—opals, rubies, sapphires and emeralds.

GEORGE FARWELL.

Among those who attended the memorial ceremony were four men closely associated with the 1928 trans-Pacific flight: John Ulm, son of co-pilot C. P. T. Ulm; Capt. Harry Lyon, navigator on the flight; James Warner, radio operator; and Wilfred Kingsford Smith, one of "Smithy's" brothers. (Right) "Southern Cross" on Sydney's international airport when she made her last flight some five years ago; alongside is a DC-6 of British Commonwealth Pacific Airlines, absorbed into Qantas in 1954.

DHC.4 CARIBOU

A Challenging New STOL Aircraft

IN the tracks of the world-leading DHC.2 Beaver and DHC.3 Otter comes the DHC.4 Caribou twin-engined STOL transport. Weighing about as much as a DC-3 (24,000 lb) it has the ability to take off and land in a distance of less than 500ft. Construction is characteristically sturdy and the engines are Pratt and Whitney R-2000s. Payloads of up to 3½ tons are possible.

The development of the Caribou was under consideration by de Havilland Canada for over two years before the decision to proceed was made in January 1957. The prototype which has recently flown (the first aircraft ordered by the Canadian Government) will be used "for extensive evaluation trials to validate its certification." The first of five ordered by the United States Army "off the shelf" should be delivered in February 1959, and present planning calls for commencement of the first batch of twenty production aircraft early next February. The target date for delivery of the first civil model is March 1959. Price will be approximately $495,000.

The military version of the Caribou will carry 28 fully equipped troops or 33 paratroops, and the rear door can be opened in flight for the dropping of troops or loads. An air ambulance version would take 14 standard army stretchers and ten seats for attendants and/or sitting cases; and the cabin will accept two Army jeeps. As a passenger aircraft the Caribou will seat 27. Cargo payloads will vary from 7,383 lb, with fuel for 200 miles, to 6,038 lb with 600 miles range. Cruising speed is 183 m.p.h. at about 51 per cent take-off power and touch-down speed about 60 m.p.h.

The Caribou, with its systems and equipment, has been designed for routine inspection and maintenance with very limited facilities, and special attention has been given to the ease with which components may be replaced. The aircraft is built to function over a temperature range of −40 deg F to +120 deg F, and provision has been made for a winterization kit to extend the lower temperature range to −65 deg F.

The fuselage is of all-metal construction and of a shape that can be seen in the photographs and three-view drawing on these pages. The under-side of the upswept rear portion is in the form of an inward-hinging door. In a belly landing the beams on which the cargo-compartment floor is carried would serve as skids. Vertical and side crash-loads are absorbed by a bulkhead and by massive frames at the front and rear wing spars and at the rear of the cabin. A crew emergency escape hatch is in the roof—additional to the entry hatch in the belly of the cockpit compartment. Three passenger emergency-exits are provided in the cabin; moreover, the upper section of the rear cargo door is jettisonable, providing a fourth emergency exit from the cargo hold.

Although designed to be operated by a two-man crew, the Caribou can, in fact, be handled by one pilot for short-haul, high-density operation. Though comprehensively equipped the cockpit is claimed to remain functional and simple. Engine controls are mounted on an overhead console in the roof. Throttles are shoulder-high and can be moved by the pilot over their full travel without awkward reaching. In the same bank with the throttles are pitch and mixture controls. Overhead engine controls were chosen for their twin advantages of maximum pilot convenience and of leaving the instrument facia uncluttered. Also on the overhead console, the undercarriage lever falls conveniently to hand at the end of the throttle travel. Aft of the engine controls on the overhead console are the aileron trim, ignition switches, flap-control lever and carburetter air-temperature control levers. The rear section of the overhead console carries the fuel-cock controls. When in use, the radio control console is located between the pilot's and co-pilot's seats; when not in use, on the ground or in flight, the console slides forward on runners into the instrument facia. The nosewheel steering wheel is on the port cockpit wall, enabling the pilot to steer whilst in the normal sitting attitude.

All-round visibility from the cockpit is claimed to be exceptionally good. The cockpit glass area—including the windscreen, canopy and side panels—totals 32 sq. ft.

The Pratt and Whitney R-2000-7M2 engines complete with propeller, accessories and cowlings, are identical, and are fully interchangeable one with another. Cowlings are of petal type, to facilitate inspection and maintenance. The main undercarriage legs are likewise interchangeable and identical. To prevent mud, stones, grass and other foreign objects entering the wheel-well, or damaging the doors during rough-strip operation, the nosewheel doors are closed when the gear is down. The nose units has twin wheels and is power steered through ±62 deg giving a minimum turning radius of 27ft. All three units of the undercarriage were designed and constructed by Jarry Hydraulics, and permit a vertical rate of descent at touch-down of 17.4ft/sec.

All fuel is contained in the outer wing panels, outboard of the propeller discs. Each system consists of ten interconnected fuel cells which can be readily inspected through individual access panels. Rapid over-wing refuelling is possible through a 3in diameter receptacle on each side.

A 3,000 p.s.i. hydraulic system operates the flaps, nosewheel steering, landing gear and brakes. All hydraulics are independent of engine-driven pumps, the source of power being an electric pump contained, together with the accumulator, reservoir, etc., in a readily removable power pack assembly. Main undercarriage emergency lowering is achieved by manually releasing the uplatches, allowing slipstream and gravity to lock the gear down. For the nose gear two emergency means of lowering are provided. One is a separate hand pump operation; the other is a "blow-down" air-bottle. In the event of an electrical system or main hydraulic failure, the accumulator can be manually pumped to full operating pressure for the operation of all services. The brakes, which are served by the main hydraulic accumulator, have an additional emergency accumulator, which can be manually recharged to operating pressure. As an additional safety measure the brakes have a manually operated emergency air-bottle.

Rudder trim is mechanical; aileron trim is electrical; tailplane trim is electrical, with an emergency mechanical system in reserve. Electrical supply is by two 300 amp, 28 volt D.C., low-speed

After a series of "touch-and-goes," the Caribou, with DHC chief engineering test pilot G. Neal at the controls, makes a run with everything down.

The Caribou as seen from the "chase" aircraft, with the full-span, double-slotted flaps in evidence.

generators, which operate at engine idling-speed, to ensure constant charge. Alternating current systems provide for essential flight instruments and windscreen de-icing. All wiring is designed to be readily accessible and removable, with minimum disturbance of upholstery.

The fuselage floor is 45in from ground level to match truck-bed height; the rear-loading door is full-width—73in wide and 75in high. Structural provision has been made for installation of an overhead cabin monorail, capable of taking a load of 2,000 lb, to facilitate manhandling heavy loads along the cabin length. Provision has also been made in the forward cabin for a winch, to be used in conjunction with the monorail. Transition from the 27 folding-seat passenger version to the cargo-carrying version and back again can be accomplished in a matter of minutes by one man. Cargo can be loaded and unloaded with the engines idling. Quick loading and turn-round time are primary considerations. The rear-loading door retracts into the roof structure permitting a lorry to back into the opening.

The 27 "utility" type seats are of light-weight tubular construction and are designed to fold up against the cabin wall to facilitate mixed passenger/freight operations. Thus, there is no need for removal and storage of the seats when cargo is carried instead of passengers. Provision has been made for the installation of airline-type chairs if required.

The Caribou main and nose shock-absorber struts are of two-stage type, giving a very small deflection from the normal ground attitude and a near-level cabin floor during all stages of loading and unloading. Uncomfortable nose dipping during taxying and braking are, it is claimed, reduced by this feature. The short stroke, for ground handling, does not interfere with the long-stroke characteristics required for the high energy absorption of short, rough-field landings.

As was stated in *Flight*'s special "Commonwealth Aircraft Industries" number of August 22, the performance of a turboprop version of the Caribou has been analysed by the company and a preliminary model specification has been written describing this aircraft. Details are for the present withheld.

DHC.4 CARIBOU

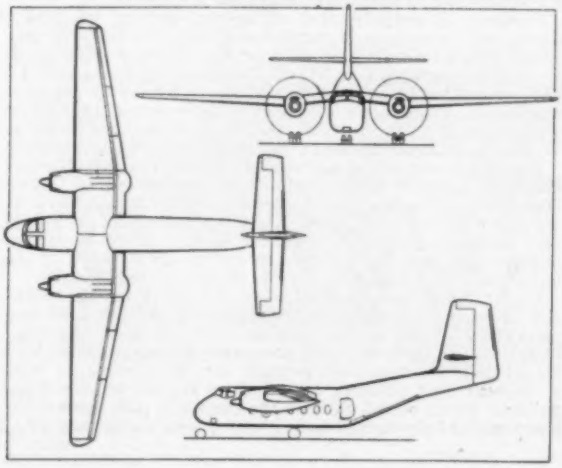
Two Pratt and Whitney R-2000-7M2 piston engines giving 1,450 b.h.p. at 2,800ft for take-off

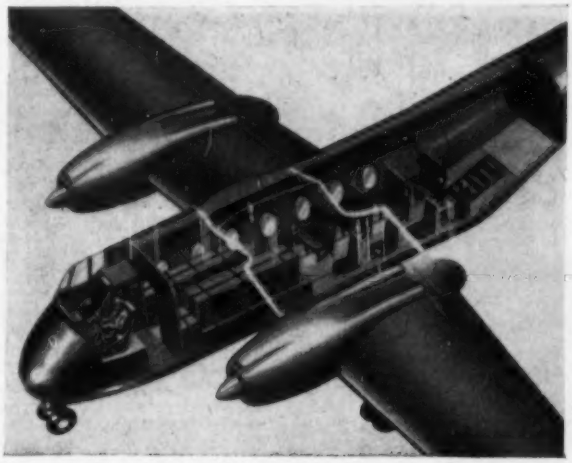
Dimensions: Span, 96ft; length, 68ft 10in; height, 31ft 10in; wing area, 912 sq ft; aspect ratio, 9.9.

Weights: Basic weight, 14,812 lb; gross weight, 24,000 lb.

Performance (short-field technique): Ground run, 490ft; distance to clear 50ft, 840ft; landing run (dry concrete), 425ft; distance from 50ft, 1,000ft; service ceiling, 24,900ft; stalling speed, 60 m.p.h.; max. weak-mixture cruising speed, 183 m.p.h. at 7,500ft; max. range, 1,350 miles.

The three-view drawing below emphasizes that the Caribou is one of the most distinctive transports yet flown. The cut-away drawing shows stowage.





THE NEW AIR AGE

Points from Papers by Eminent Authors at British Association Meeting

PROBLEMS of speed and propulsion in the air, some of immediate importance and others having a bearing on likely developments in the not-far-distant future, were discussed at the recent meeting of the British Association, held at the University of Glasgow.

Nuclear propulsion, and its applications at sea, in the air and on land, was the subject of the paper delivered by Mr. J. Edwards, Head of the Naval Section of the Atomic Energy Research Establishment at Harwell. He remarked that the advantage of long endurance in a nuclear-powered aircraft was not immediately obvious and it was hard to see any incentive, at least in the commercial field, to applying nuclear power to aircraft.

Anticipating the arrival of civil aircraft with a maximum take-off weight of about 300,000 lb, cruising at 550 m.p.h. over a stage-length of about 3,000 miles, and requiring a take-off thrust of 70,000 lb, Mr. Edwards said that the structure would probably account for about 30 per cent of the all-up weight, the engines about 8 per cent, the fuel 45 per cent, and the payload between 10 and 15 per cent. A supersonic version operating over the same range might have an all-up weight of 400,000 lb; the structure would account for about 25 per cent of the all-up weight, fuel 55 per cent and payload less than 10 per cent.

Nuclear plants for the same type of aircraft would, in the subsonic version, require a reactor of about 120MW of heat to produce the cruising thrust. This would need an investment of some 60 kg of U235 and confer a range of about 100,000 miles before reprocessing of the fuel elements was necessary. The structure weight would account for 30 per cent of the all-up weight, but the reactor and shielding, plus the turbojet units, would now account for about 60 per cent and would be concentrated in the region of the reactor and around crew and passenger positions.

Mr. Edwards estimated the cost at about £4,000,000 and added that a supersonic version would need a core producing some 600MW of heat and an investment of some 300 kg of U235.

Reactor-shield Weight Penalties

If an aircraft was envisaged with the crew 100ft from an unshielded 300MW reactor, the weight of shielding round the crew compartment to reduce the dose rate to ten times the maximum permissible level might amount to about 80 tons, that weight providing for little or no attenuation of radiation in all other directions. If the reactor was fully shielded in the crew direction, but only partially shielded elsewhere, the shield weight would probably amount to something over 110 tons.

Minimum shielding would probably be achieved by placing some round the reactor and some round the crew compartment. Strict attention would have to be given to the total radiation dose acquired by the crew and it was probable that only a limited number of hours flying in a nuclear aircraft would be permitted. Crew-cabin layouts were bound to be cramped and visibility was likely to be worse than in conventional aircraft, because of the scattering properties of the air and the reflection of escaping radiation back into the compartment.

The jet units would probably have to be fuselage-mounted in the vicinity of the reactor to reduce heat distribution problems and, since take-off and landing weights would be virtually unchanged, the landing gear would have to be of very robust construction.

Because of the considerations of reliability, safety, and the greatly increased power requirements for take-off it appeared probable that conventional chemical fuel and perhaps even additional turbojet units would be required for take-off and landing purposes, and possibly for emergency cooling.

There were other problems that could not be overlooked—support facilities required in the way of specially shielded vehicles for crew disembarkation and loading; bays and pits for removing the active reactor system; and special ground-support equipment. In the initial stages at least airfields would require remote siting.

Crash hazards, however, were the dominant factor. One serious crash might scatter most of the heavy structural items over a half-mile to one-mile radius and lighter pieces over a linear spread of some five miles, releasing great radio-activity. Even if the core remained intact, there would almost certainly be loss of coolant and a distinct probability of fuel elements melting from the decay heat. Ground contamination would be intense and arrangements would have to be made to remove the contaminated earth.

"It is for these reasons," Mr. Edwards declared, "that it seems that nuclear-propelled passenger aircraft, even if they are confined to sea flights only, are unlikely to be realized for many years."

Dealing with *Aerodynamic Aspects of High-speed Flight*, Mr. L. F. Nicholson, Head of the Aerodynamics Department of R.A.E. Farnborough, discussed configurations and engine efficiency towards the attainment of flight at Mach 4 to 6 and considered whether or not air friction made such speeds practical for long-range flight.

It was easy to become frightened by the very high temperatures which were associated with such high speeds, but the temperatures normally quoted were those appropriate to a body in equilibrium with the air neglecting radiation. In practice, the air friction was always trying to raise the temperature towards this equilibrium value and radiation from the hot surface was trying to keep the temperature down. The very rapid increase of radiation from the surface with increasing temperature and the reduction in the rate of heat input which went with increasing altitude suggested that, if very-high-speed flight was associated with very high altitudes, the surface temperatures might not be too great—not above 600 deg C.

Such a temperature, while it set formidable problems for manned flight, was certainly not so high that, with available structural materials and insulating and refrigerating techniques, the prospects for long-range transport were impossible up to Mach numbers of around 5. "So far," continued Mr. Nicholson, "we have seen good prospects for economic supersonic transport at twice the speed of sound or more, and the more distant prospect of transport at speeds up to five times the speed of sound. If we look to still higher speeds, it is no longer even a reasonable approximation to consider only the constant-speed cruising phase of flight and ignore the lengthy final glide to earth.

At ten times the speed of sound and upwards, appreciable ranges could be obtained in ballistic flight. Mr. Nicholson noted the problems of re-entry and said that if one looked merely at the equivalent in heat of the kinetic energy which had to be dissipated in slowing down from 15,000ft/sec the prospect looked frightening. However, much of the energy could be diverted into heating the air rather than heating the aircraft.

Even if all the deceleration of the aircraft took place through skin friction and the surface was cooled and maintained at normal temperatures, only about half the energy would appear in the body and half would be left in the wake. By designing for low heat input, the proportion of heat absorbed to heat left behind in the wake might be reduced to one-tenth. Much of this could be rejected by radiation with surface temperatures of a few hundred degrees C, provided sufficient time was allowed to reject the heat.

For very steep trajectories little could be done to provide time, but for reasonably shallow trajectories the use of aerodynamic lift, precisely controlled, could give time for heat to be rejected and could stretch re-entry time from seconds to minutes. At the same time the use of lift for this purpose could also reduce the deceleration to very modest values—to excess g of less than 1.

Space-flight and Physiology

In a paper given before the Physiology Section of the Association, A. Cdre. W. K. Stewart, Officer Commanding the Institute of Aviation Medicine, described the physical and mental calibre of the men who would be chosen to make manned flights into space. If the task was merely to remain conscious throughout the flight, this was easily achieved, because the pilot had only to remember his escape mechanism; but to use the man fully would involve one so skilled that the only type envisaged was a test pilot. The demand would be for a person of such temperament that his nervous system would remain normal in stresses.

Problems of weightlessness encountered beyond the earth's atmosphere were not insuperable, said A. Cdre. Stewart, but they would include disturbances of muscular co-ordination and the nervous system leading to awkward function of certain reflexes. There might be long-term effects upon respiration and disturbances of the alimentary canal. There would almost certainly be a reduction of the input of information to the sensory pathways of the brain, and this did have some effect on the mental processes.

Radio aids to navigation were described by Mr. Caradoc Williams, Assistant Director (Engineering) at the R.A.E. Radio Department. He stated that there was still scope for original contributions in the field of radio aids to aeronautical navigation, such as the provision of a relatively simple aircraft-separation monitor for safety purposes and by further development of the techniques of automatic radio guidance to an airfield runway.

Under conditions of bad visibility, the last phase (the touch-down) was still exceedingly difficult for the pilot to complete, particularly in some military machines where the design characteristics unavoidably restricted his downward vision from the cockpit. To aid the pilot at this stage, methods were being developed using a magnetic field guidance cable on the ground for directional guidance which would, through the automatic pilot, control the movements of the aircraft until it was at rest on the runway.

M.R.F.

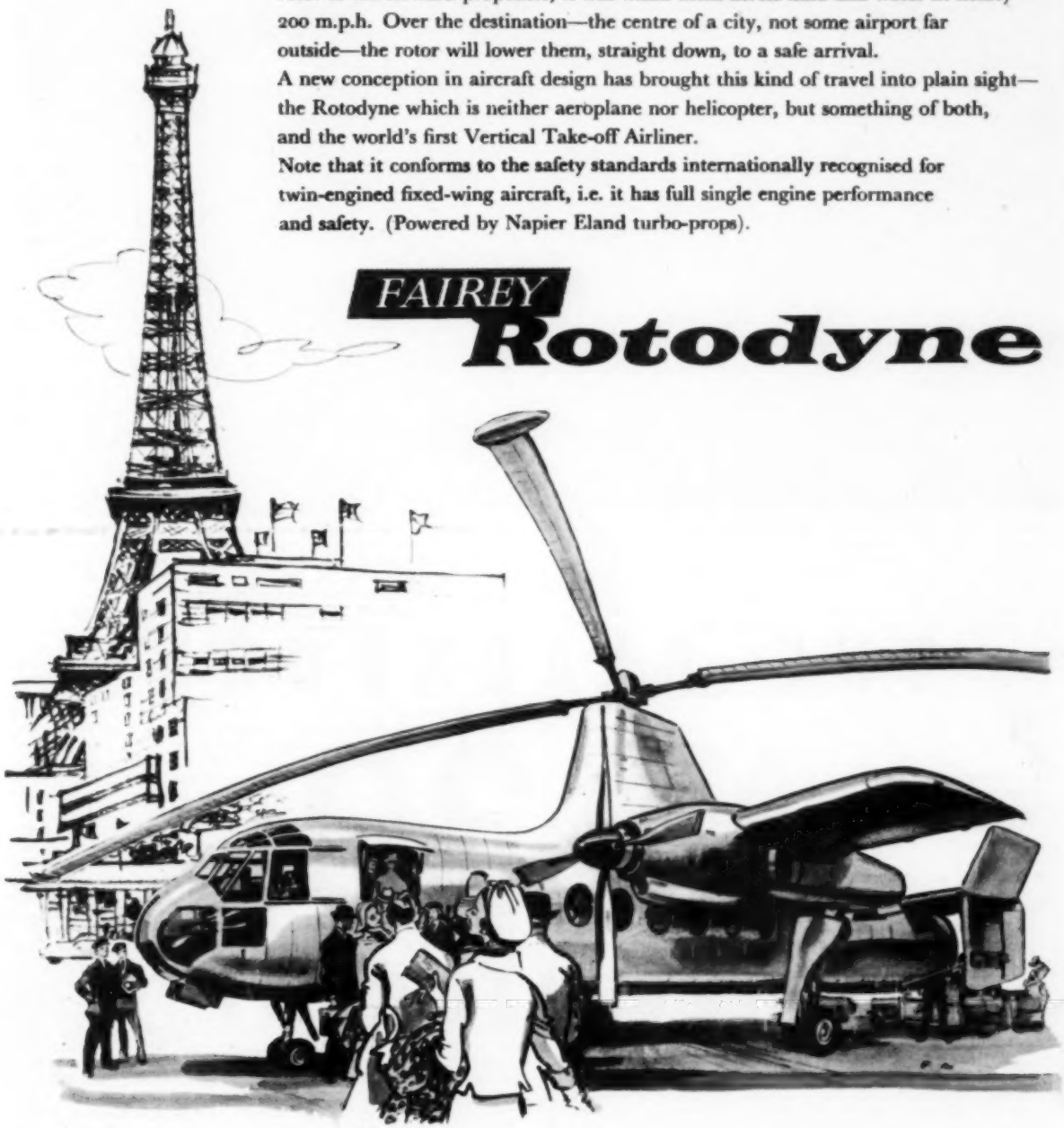
LOOK FORWARD TO **Rotodyne** TRAVEL

This is how people will go from city to city, when we have Rotodyne travel. Forty-eight people will settle themselves in the wide, comfortable cabin of the Fairey Rotodyne, at some small open space in the middle of a town. The Rotodyne will lift them vertically far above chimney-smoke and church spires—and then, gradually transferring the power of its two turbine engines from the big rotor to the forward propellers, it will whisk them across land and water at nearly 200 m.p.h. Over the destination—the centre of a city, not some airport far outside—the rotor will lower them, straight down, to a safe arrival.

A new conception in aircraft design has brought this kind of travel into plain sight—the Rotodyne which is neither aeroplane nor helicopter, but something of both, and the world's first Vertical Take-off Airliner.

Note that it conforms to the safety standards internationally recognised for twin-engined fixed-wing aircraft, i.e. it has full single engine performance and safety. (Powered by Napier Eland turbo-props).

FAIREY Rotodyne



THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

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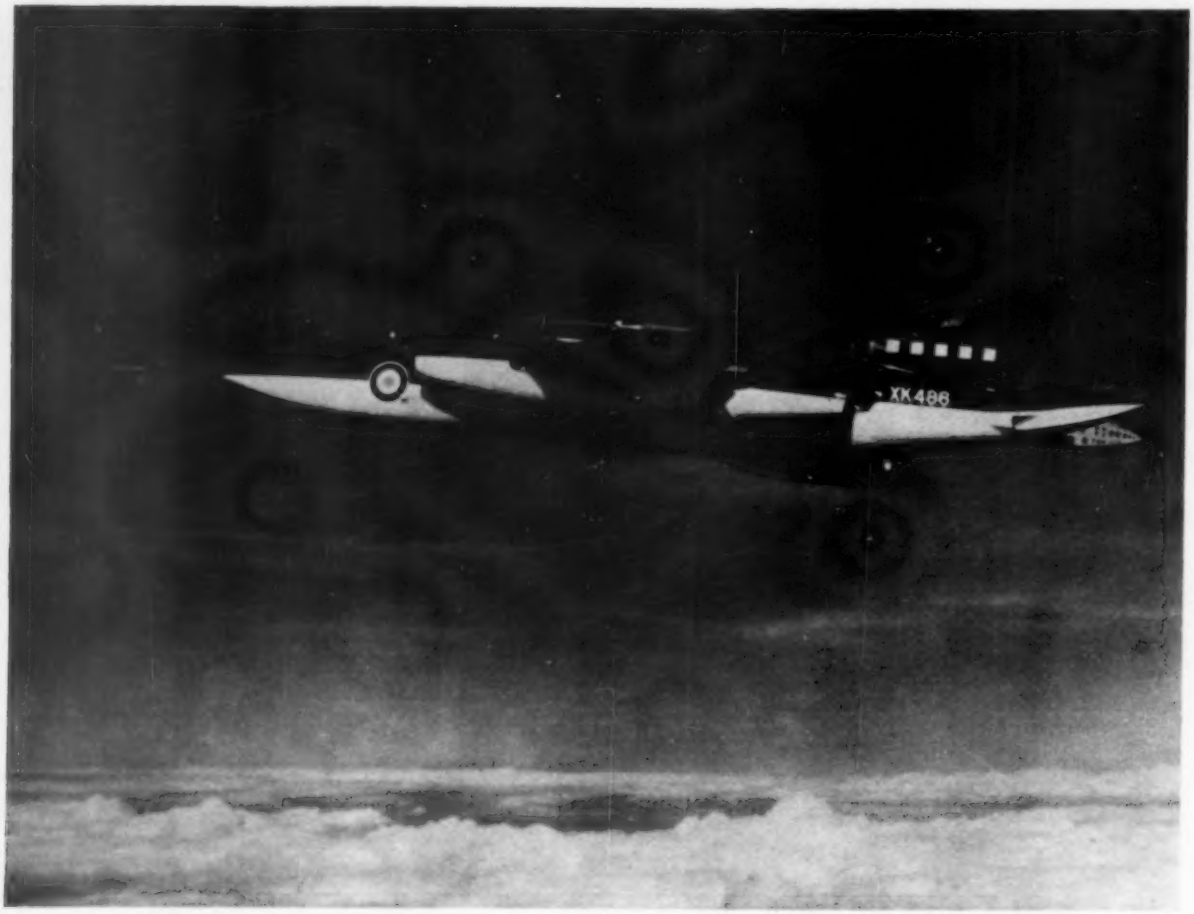
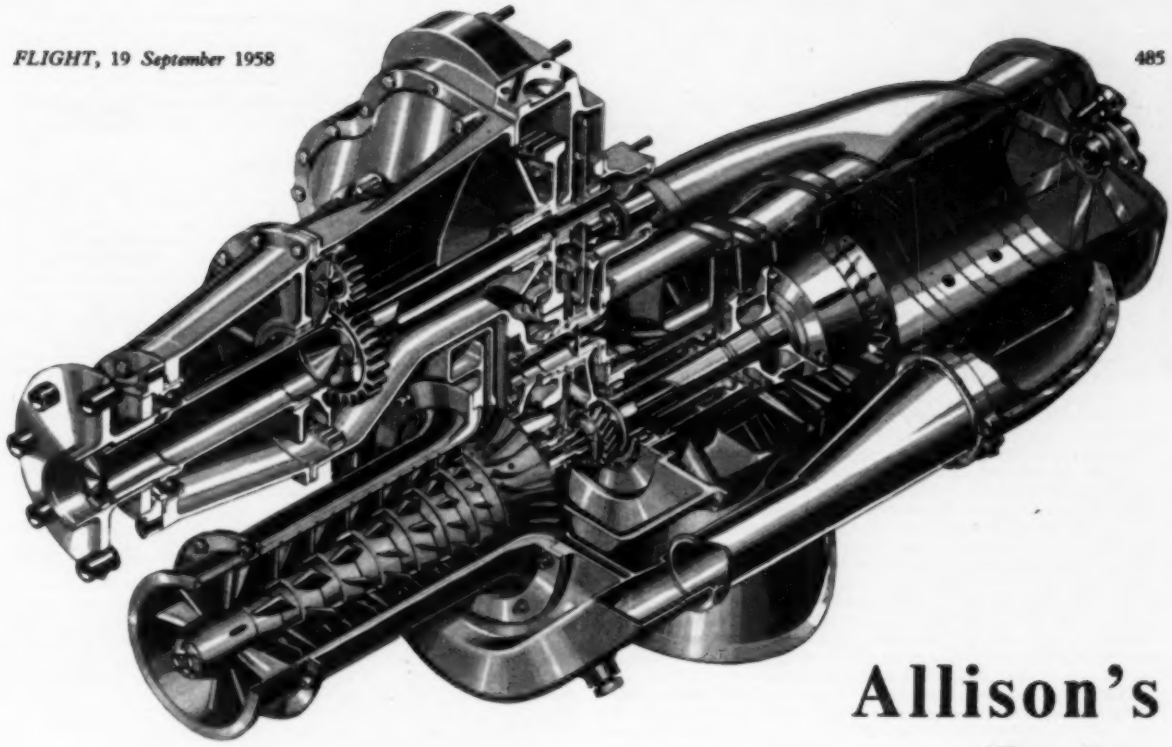


THE BLACKBURN NA.39 STRIKE AIRCRAFT

Blackburn and General Aircraft Limited. Brough. E. Yorks. England

A120/a



Allison's Baby

A 250 H.P. TURBOSHAFT UNIT WITH OUTSTANDING POTENTIALITIES

DURING the past fifteen years the aviation gas-turbine has been extremely successful in its fight to displace the piston engine. The latter has been ousted from one preserve after another until today its sole domain is that of the small engine. By this we mean units of under 1,000 h.p., and even in this field the piston engine has been attacked with some success—particularly by M. Szydlowski's Soc. Turboméca.

Lowering the bottom limit of the range of practical gas turbines is a technical exercise of the utmost difficulty. In the automotive field most designers seem to have been sidetracked by heat-exchangers and other modifications to the thermodynamic cycle in an attempt to overcome the handicap of a ridiculously low pressure-ratio. In the aeronautical sphere specific fuel consumption is slightly less important, yet other factors—particularly that of cost—have militated against the small gas-turbine.

In fact, although the prize is enormous—possibly extending to millions of engines—no manufacturer has yet succeeded in producing a small turbine of the right efficiency at the right price. One firm, however, seems to be on the brink of doing so: the Allison division of General Motors. It is fortunate that they are part of the biggest engine-company in the world, for the development of even a very small gas-turbine is a task calling for massive manpower and monetary resources.

It was largely the financial strength of GM which gave Allison the chance to go ahead with the Model 250, as it is known. Last winter the U.S. Army held a competition for a 250 h.p. turboshaft engine and, although their entry was technically excellent, the factor that clinched the deal for Allison was undoubtedly their willingness to bear all development costs in excess of $4m. Other companies could not quote less than several times this figure. The award of a U.S. Army/U.S.A.F. development contract was announced on June 25.

Key factor in a gas-turbine is its compressor. One might have expected the engineers at Indianapolis to choose a transonic axial unit, but they actually went to the other extreme. By adopting an axial assembly with a modest value of work-per-stage they achieved a break-through which slashed the cost of the most expensive item at one stroke: each stage in the Model 250 is precision cast (in an Al-Co alloy) complete with blades. Likewise the final centrifugal stage needs practically no machining.

From the diffuser the compressed air is delivered through a pair of lateral ducts to the single reverse-flow combustion chamber. The fuel may be any standard hydrocarbon, although the engine is being designed for JP-4 or 115/145-grade petrol. There is a single duplex injector nozzle and a single igniter energized by an exciter fed from a 24-V D.C. system. The combustion chamber itself makes use of techniques evolved with the T56 and Model 501 turboprops.

Immediately downstream of the combustion chamber is an annular exit in which are mounted the stators for the single-stage gas-generator turbine. Like the power turbine this is formed in a single precision-casting operation, complete with blades. It drives the compressor via a central shaft, which terminates in a male spline; the latter mates with the stub-shaft at the rear of the compressor, which is located within the central ball thrust bearing. The power turbine has two stages and is overhung beyond its own ball bearing. It drives a tubular shaft terminating in a helical output pinion, the remaining gears being clearly visible above.

Exhaust gases are turned smartly downwards and issue beneath the centre of the engine. A prominent wheelcase, half cut-away in the drawing, provides drives for a hydraulic torquemeter, hydraulic brake, tachometers and control units for the gas-producer and power turbine, the fuel and oil pumps and a starter/generator. The casing is cast magnesium and it really forms the backbone of the engine.

Allison are developing various versions of the 250, the two principal types being the turboprop illustrated (output r.p.m., 2,000) and a turboshaft version (6,000 r.p.m.) with a different front cover. The latter would have pilot-control of the output as well as the basic hydromechanical system operating on the gas-generator. Wisely, Allison have made the 250 a "hot-day" engine. Torque is limited to that giving 250 s.h.p. and four chromel-alumel thermocouples hold turbine-inlet temperature to 1,750 deg F. The latter figure would be reached only on a 100 deg F day, so that on standard days rated power can be obtained up to from 7,000 to 13,000ft (depending on airspeed).

Illustrative of Allison's attention to the needs of private owners, truck drivers, operators of remote radar stations and the innumerable other potential customers is the remarkable ease with which maintenance may be effected. The compressor comes off after removing three bolts and disconnecting an oil line; either turbine can be replaced without rebalancing, and the combustion chamber is removed merely by undoing a vee-clamp and breaking the lines to the igniter and burner.

Rig-testing has been extensive and the first complete build is now probably complete. Deliveries could possibly start inside eighteen months and Allison will probably ask less than $15,000; certainly they are basing their costing on a huge run, and the field seems to be wide open to them.

Basic data for 250-B2 turboprop: (-C2 turboshaft figures, where different, in parentheses). Overall length, 38.5in (34.6); width, 15.8in; height, 19.5in; dry weight 106 lb (90); mass flow, 3 lb/sec. Performance (free-turbine speed 100 per cent, ram 100 per cent, JP-4 with lower value of 18,400 BThU/lb: guaranteed s-l. static figures, 59 deg F, maximum 250 s.h.p. (min.) with s.f.c. of 0.7, normal 212 s.h.p. (0.73), 90 per cent 191 s.h.p. (0.76), 75 per cent 159 s.h.p. (0.81); s-l. static, 100 deg F, 250 s.h.p. (0.73); 6,000ft, static, 95 deg F, 206 s.h.p. (0.72). W.T.G.

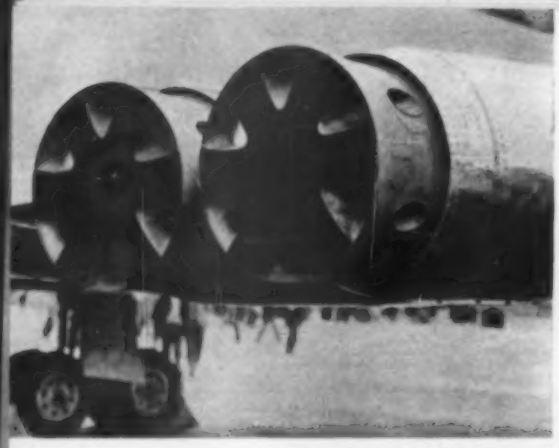


Fig. 1 (left). Rolls-Royce Avon silencer on the de Havilland Comet 4.

Fig. 2 (right). Ejector nozzle and illustration of terms.

SPANISH CONFERENCE

(continued from page 479)

JET ENGINES AND NOISE

Perhaps one of the most keenly anticipated sessions of the week was the morning of September 10. In four hours four papers on the topical subject of jet aircraft noise were read and discussed. Pride of place went to *Progress in Jet Engine Noise Reduction* read jointly by **F. B. Greatrex** and **D. M. Brown** of Rolls-Royce. The jet silencer, said Mr. Greatrex, is unique in that it is the only item of equipment which has to be installed yet does not contribute to the safety of the aeroplane or the comfort of the passengers. A late start and the effect of competition (causing a duplication of effort) has made the cost considerable. The most satisfactory solution is undoubtedly the low jet velocity engine; but at this stage high jet velocity—the most powerful of the variables affecting noise generation—has had to be accepted.

Describing the test equipment used by Rolls-Royce, Mr. Greatrex said that a small scale jet (a Blackburn Palas 600) had been adopted "somewhat reluctantly" because of the economies it offered in time and material when obtaining systematic data on a series of nozzles. Earlier, difficulties had arisen in correlating quarter scale and full size results. The company also used a Canberra for full scale testing because it would operate over a wide range of conditions on one engine.

The test technique was described by considering the significant variables, not all of which can be controlled. At distances of 100 to 500ft noise measurements on a constant full scale source of jet noise appear to obey a (distance)^2 law, but below 50ft deviation increases rapidly. Some work was done in order to derive values of peak-to-peak polar attenuation from silencer geometry since, where several geometries of a given type would give the same attenuation, correlation would fix optimum designs. The various geometric aspects were considered under the headings of area ratio, number of corrugations, thickness ratio, and central nozzle effect. Considering these in turn it was explained that provided primary nozzle pressure ratio and primary jet temperature ratio are confined to a small range, the outlet conditions and consequently the noise level is determined by the ejector area ratio (see Fig. 2) only. Multiplication of the number of nozzles permits a shorter ejector tube for the same noise and in the limit we have an infinite number of nozzles distributed uniformly within a circle of the same area ratio and producing the same noise.

Thickness ratio is the division of the final nozzle in a way other than by corrugation alone, and is defined in the diagram. In fact a central nozzle is frequently adopted because it is seldom practicable to use full depth corrugations because of the drag of the base fairing.

Mr. Greatrex summed up the effects of a silencer as (1) the interception of generated noise, (2) reduction of noise generated by interference with mixing regions. Against this, performance penalties increase with attenuation. Arbitrary penalties for a developed silencer giving 10 db attenuation might be one per cent each for T.O. thrust loss, increase of cruise specific fuel consumption, net thrust loss in cruise external drag and T.O. thrust loss in additional weight. The acceptable level of noise is highly controversial, and depends upon spectrum character and level, duration of exposure, repetition rate, background noise, time of day and adjustment to exposure. If the level chosen is that of presently operating aircraft the attenuations realized (on the Comet 4 for example) are not unreasonable. It seems prudent to be practical rather than idealistic in choosing noise levels since each one per cent penalty costs between one and two per cent of the payload—that is, in total, between four and eight per cent.

In the discussion on their paper, Mr. Greatrex and Mr. Brown were asked if they thought that high frequency noise caused most of the trouble. Yes, said Mr. Greatrex, H.F. noise appears to annoy observers more; the type of low-frequency window-rattling noise did not give much trouble with jets.

Following the Rolls-Royce paper on noise was a contribution by **K. K. Neely, B. Etkin** (who read the paper) and **H. S. Ribner** on specific experimental and/or theoretical investigation related to the physical and bio-acoustic aspects of the noise problem.

As this paper was generally rather theoretical in treatment the second lecture to be summarized on the subject of noise is that delivered by **William Littlewood** of American Airlines. His subject was *Noise in Jet Transport*.

Mr. Littlewood opened his remarks by saying that the important parameters of noise are pressure, quality, frequency of repetition and background noise level; hence noise had a physical, physiological and psychological significance. In his view, noise in jet transports affected (1) the cockpit, (2) cabin, (3) airport, (4) maintenance areas, (5) neighbouring community and (6) aircraft structure and equipment. Elaborating on this, he said that in the cockpit and cabin there were aerodynamic noises due to forward speed and boundary layer (the noise level depended partly upon structural stiffness), auxiliary component noise (for which there was very little engineering excuse), the airflow through ventilating ducts and the impingement of the exhaust efflux. There were two dangers which have not been sufficiently considered: the steady soporific noise in the cockpit and extreme quietness in the forward cabin—overheard conversations when others were sleeping could be annoying. Mr. Littlewood suggested that "conversation units" should be developed. He complained that cabin address systems were still of very poor quality; they should be improved and the pilot given a speech-volume indicator.

With regard to the noise of the aircraft on the ramp, passengers, mechanics and service personnel were all exposed and airport visitors also had the right to expect protection. The noise from the early compressor stages was just as annoying as jet blast and deflecting barriers should be erected between the fingers of a terminal. High frequency noise must not penetrate airport buildings; the noise of engine starting—particularly by A.P.U. and air turbine starter—should also be taken into account. In the maintenance area protection must be provided for servicing personnel by distance, by ground silencers and, where necessary, by ear muffs.

The community noise problem, Mr. Littlewood remarked, was the most critical of all. Community noise tolerance was balanced against fear (threat to property), irritation (threat to activity) and even politically inspired resentment. Our only answers were noise suppressors, separation and choice of runway direction and

Note: all the figures above and below are from the paper by Greatrex and Brown

Fig. 3. Variation of minimum penalties with noise attenuation.

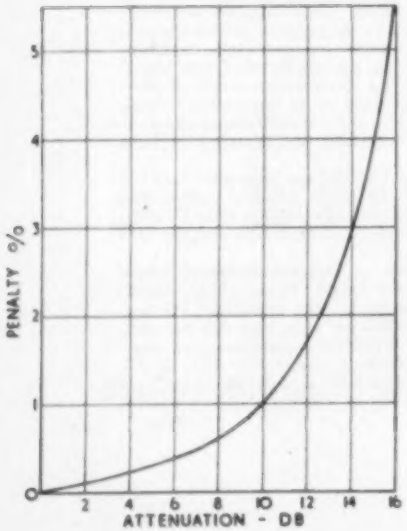
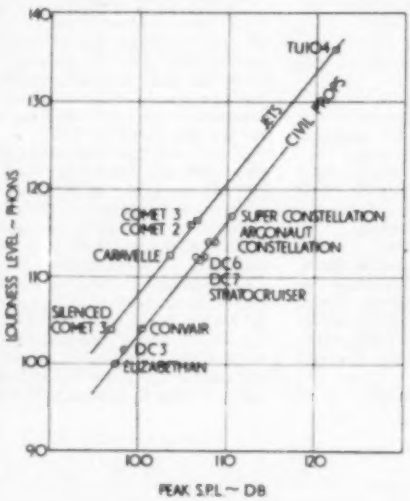
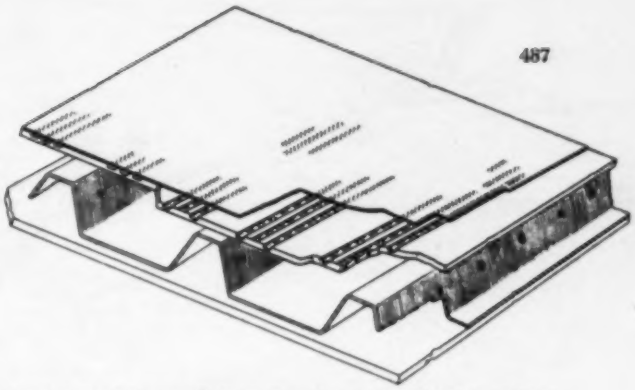


Fig. 4. Comparison of absolute values of loudness level of jet- and piston-engined aircraft. S.P.L.=Sound pressure level.





The Handley Page type of perforated suction surface with cells incorporated in the skin. The weight penalty is about 8 oz/sq ft.

climb techniques. A most important consideration was that "our ability to cope with engines of the future cannot be by extensions of existing techniques—a more fundamental method must be found." Six areas for research were suggested: (1) by reducing jet velocity by ducted or by-pass fans to achieve a reduction of 15 db; (2) improved detail design; (3) reduction of silencer flight losses and drag; (4) more research beyond the excellent parameters suggested by Lighthill; (5) compressor inlet noise reduction and (6) airport planning to achieve noise control.

During question time on this paper it was suggested that community tolerance (expressed in levels of complaint and legal action) varied from country to country, depending particularly upon how easy it was to go to law. (In some countries, it was suggested, the slope of the curve of complaint to noise level would remain at zero!) Asked if he thought that tolerated noise levels would rise in, say, the next five years, Mr. Littlewood said that tolerance would increase and it would do so partly because national pride in aeronautical achievement would suppress criticism.

BOUNDARY LAYER CONTROL

Four lecture papers on b.l.c., one German, one British, one French and one by an Australian author, were presented during

Dr. Theodore von Kármán, honorary president of the I.C.A.S., addresses the delegates. To his right is Sr. Luis de Azcarraga, president of the Spanish Aeronautical Engineers' Association and to his left the Spanish Minister of Air, M. Maurice Roy of O.N.E.R.A. and Sr. Soler, representative of the local authority.

the Congress. The first of these was *Some Recent Developments in Boundary Layer Control*, read in English by **Dr. H. Schlichting**, who is a professor at the Technische Hochschule, Braunschweig. His contribution was to outline methods of calculating the turbulent boundary layer with suction and blowing, the derivation of equations for the stability of the laminar boundary layer with suction by slots, and an investigation into boundary layer fences and swept wings. Work at Braunschweig had shown, he said, that not only is there diminished separation on the outer part of the wings but a separated area is originated inside the fence, and for the swept wing there is a considerable breakdown of the spanwise lift distribution (which can be theoretically calculated) in the neighbourhood of the fence.

Following Dr. Schlichting's paper was **Dr. G. V. Lachmann's** *Fundamental Design Problems of Aircraft with Boundary Layer Control for Maintaining Laminar Flow.* Paraphrasing Gandhi ("There is more to life than merely increasing its pace"), Dr. Lachmann introduced his subject by saying that "there is more to flying than merely the increase of flight Mach numbers" —particularly in civil aviation where economy, safety and reliability were paramount. He then sketched in what could be done with b.l.c. and reviewed the state of the art over the last six years of research. Laminarization, said Dr. Lachman, is no panacea for all aircraft; it will come into its own where the emphasis is on long range and where high cruising altitude is permissible. To achieve long range and lower direct operating costs when operating over medium-long and long stage distances, it is necessary to improve the L/D ratio and the total efficiency with which the heat content of the fuel is converted into thrust work. Drag reduction by b.l.c. applied to the wing, tail unit and engine nacelles of aircraft operating at high subsonic Mach numbers with lift coefficients restricted to the order of 0.3 to 0.45, combined with A/Rs of 8 to 11 can double the effective L/D ratio of a large transport aircraft of conventional design.

Laminarized aircraft, continued Dr. Lachmann, have an application in nuclear powered aircraft. Here, where the minimum design gross weight is large, the lift to drag relationship determines the total reactor power, and by doubling the L/D ratio with b.l.c., shield weight in an aircraft of 600,000 lb gross weight, for example, could be reduced by 70,000 lb.

A section of Dr. Lachmann's printed paper (not all of which he was able to read) is devoted to a discussion of the engineering considerations of laminar flow, and in particular to the case for the integrated powerplant. The main elements of this aspect of b.l.c. are illustrated in the accompanying drawings.

The written paper contains three important appendices: "An approximate method for calculating cross-flow on an infinite swept wing with arbitrary velocity and suction distributors"; "a note on performance aspects of b.l.c.," and "conclusion of boundary layer flight research in Great Britain and in the U.S.A." The latter, which is particularly interesting, is reproduced here almost in full.

(1) Full-chord laminar flow may be maintained in flight up to chord Reynolds numbers of the order of 30×10^6. (2) Suction quantities required to maintain laminar flow are sufficiently small to result in net profile drag reductions of the order of 70-80 per cent, account being taken of the power required for suction. (3) Increase in Mach number, at least up to the critical value, has no adverse effect on the maintenance of laminar flow. (4) Consistent and repeatable results have been achieved using methods of construction which are essentially suitable for full-scale application. (5) Suction surfaces can be designed and manufactured in an engineering fashion with low weight penalties. (6) A complete solution to the problem of fly accretion is given by the use of simple discardable leading-edge covers or by spraying the wing and nose with a substance which sublimates under the application of heat. (7) The certainty of maintaining laminar flow by suction has been thoroughly established by intensive flying in Great Britain and the U.S.A. (8) Distributed suction applied through a finely perforated surface is more effective than suction through isolated strips of larger perforations where crossflow occurs in the boundary layer. Suction applied through closely spaced and very narrow slits is more effective than either. (9) The tolerable degree of surface roughness and waviness increases for a given flight Mach number, with cruising altitude, or increase of kinematic viscosity, respectively. Equally, accidental surface roughness caused by dust, flies, etc., becomes less critical with increase of altitude. (10) It has been observed that when flying at high speed and at great altitude, erosion of the remains of squashed flies occurs. It is probable that at cruising altitudes of 45- to 50,000ft the non-eroded remains may generally cause no trouble.

In the discussion of the paper, a U.S. contributor, **Dr. August Raspet**, of the State College, Missouri, read a short contribution of his own to b.l.c. He suggested that what was needed was both suction control for the high Mach number cruise case, and high lift-control for take-off and landing.

(Other papers from the I.C.A.S. conference will be reviewed next week.)

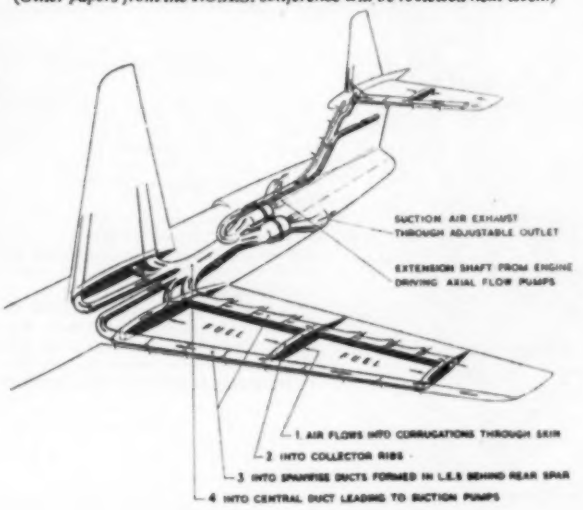
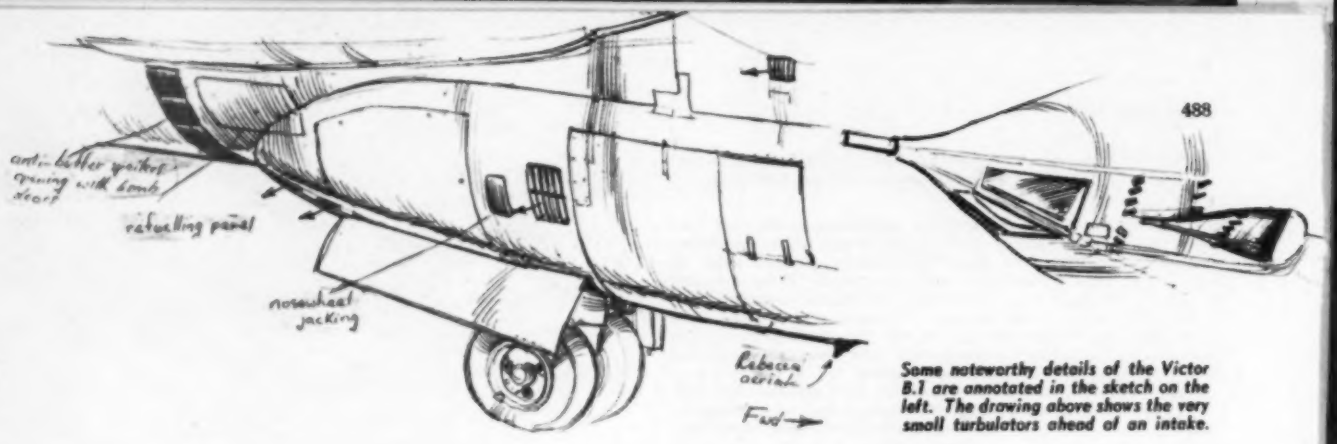

SUCTION AIR EXHAUST THROUGH ADJUSTABLE OUTLET
EXTENSION SHAFT FROM ENGINE DRIVING AXIAL FLOW PUMPS
FUEL
FUEL
1 AIR FLOWS INTO CORRUGATIONS THROUGH SKIN
2 INTO COLLECTOR RIBS
3 INTO SPANWISE DUCTS FORMED IN L.E.S BEHIND REAR SPAR
4 INTO CENTRAL DUCT LEADING TO SUCTION PUMPS

Illustration of a b.l.c. suction and ducting system for a twin engined aeroplane; resemblance to the H.P.113 project is marked.

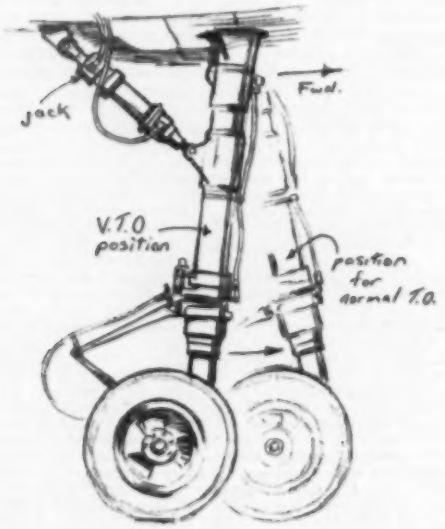


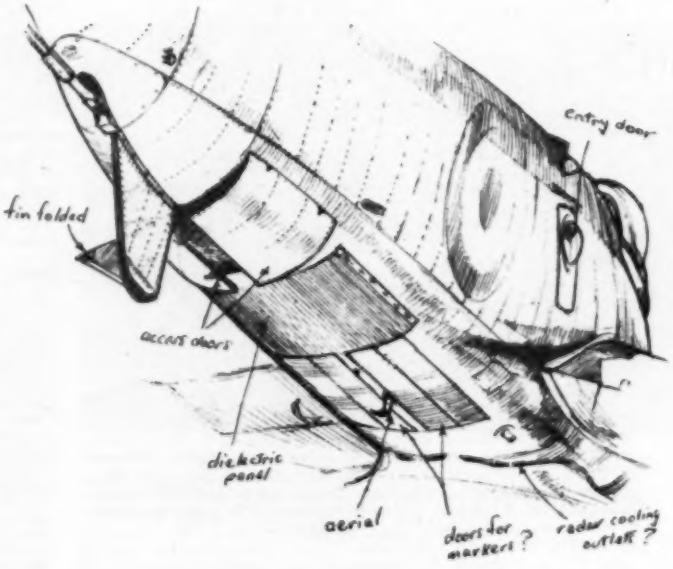
Some noteworthy details of the Victor B.1 are annotated in the sketch on the left. The drawing above shows the very small turbulators ahead of an intake.

Farnborough Sketch-book

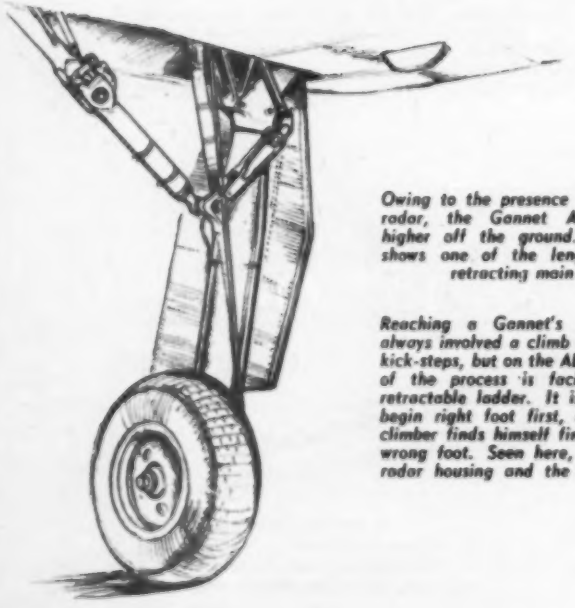
POINTS OF TECHNICAL INTEREST NOTED BY "FLIGHT" ARTISTS ARTHUR BOWBEER AND FRANK HUNGER

Short SC.1 two-position undercarriage.



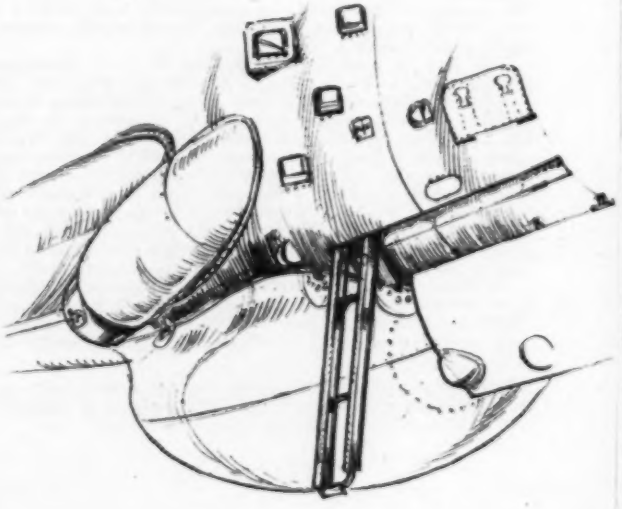


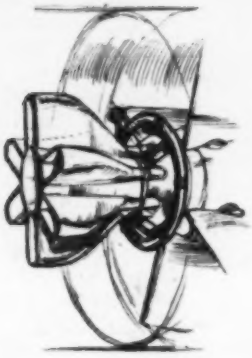
On the AEW.3 Gannet the forward fairing of the new tail bumper hinges sideways to allow room for a pair of access doors to open. Certain details noted must for the present remain speculative.



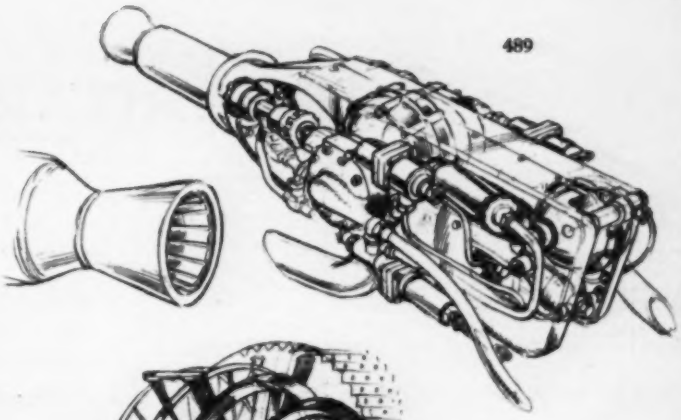
Owing to the presence of the search radar, the Gannet AEW.3 stands higher off the ground. This sketch shows one of the lengthened, pre-retracting main legs.

Reaching a Gannet's cockpits has always involved a climb up a series of kick-steps, but on the AEW.3 the start of the process is facilitated by a retractable ladder. It is essential to begin right foot first, otherwise the climber finds himself finishing on the wrong foot. Seen here, also, are the radar housing and the new jet-pipe.

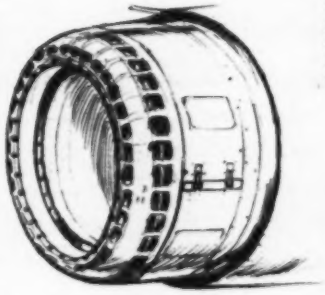


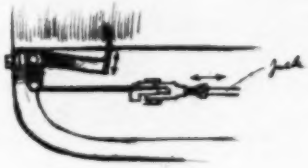


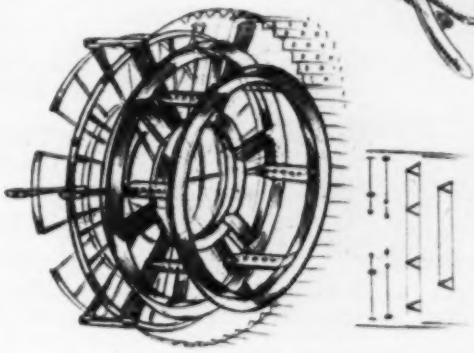
Right, the diminutive PR.23 rocket motor by Armstrong Siddeley, first described in our August 29 issue. It almost certainly runs on liquid oxygen and kerosine and has a rated thrust of 500 lb. The package weighs some 30 lb.



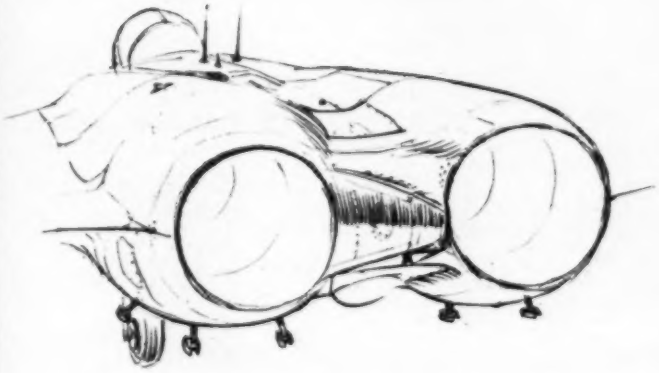
Upper left, left and below are sketches relative to the reheat system of the Armstrong Siddeley Sapphire 7R (12,300 lb thrust). Fuel is injected at the end of the tailcone, to which is attached a simple six-lobe flame holder; the sketches below illustrate the curious nozzle with twelve jacks, which can be seen on these engines in the Javelin FAW.8.







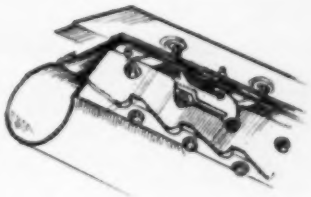
The Solar fully-variable afterburner fitted to the Bristol Olympus 201 (BOl.7R, 24,000 lb thrust).



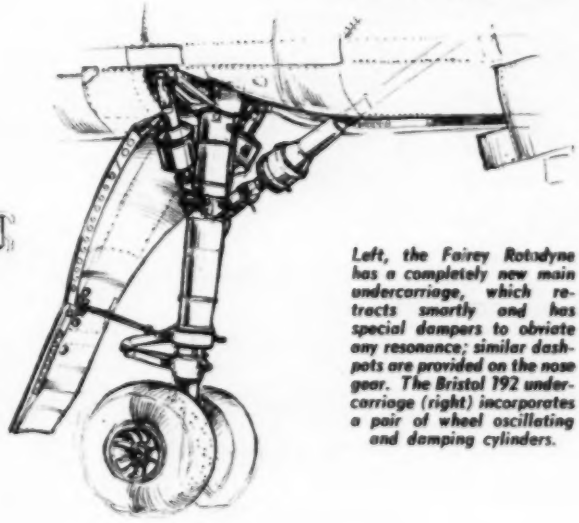
The Sea Vixen FAW.1 has extremely powerful Avons; between them lies the arrester hook; under each cowling are unusual fuel drains.

The Javelin FAW.8 has four q-feel pitots and intakes which may supply cooling air for the afterburners.

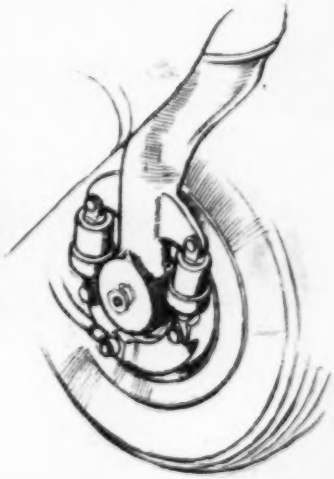
Right, a close-up of one end of a Scimitar flap blowing duct. These ducts, which are fabricated in I.C.I. Ti-130 titanium alloy by J. R. Bramah and Company, pass compressor-bleed air to provide supercirculation over the flap upper surfaces.



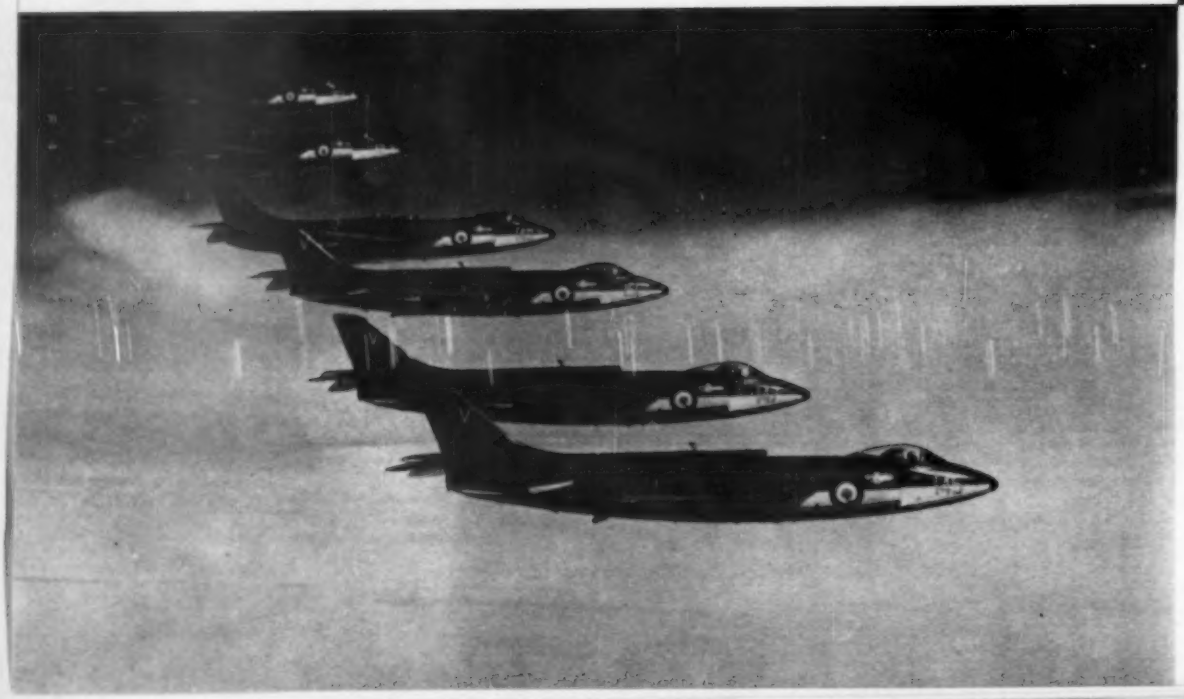
The General Electric Company exhibited this extremely neat hydraulically operated radar scanner, the azimuth control being reminiscent of a steerable nosewheel. It may be that carried by the de Havilland Sea Vixen.

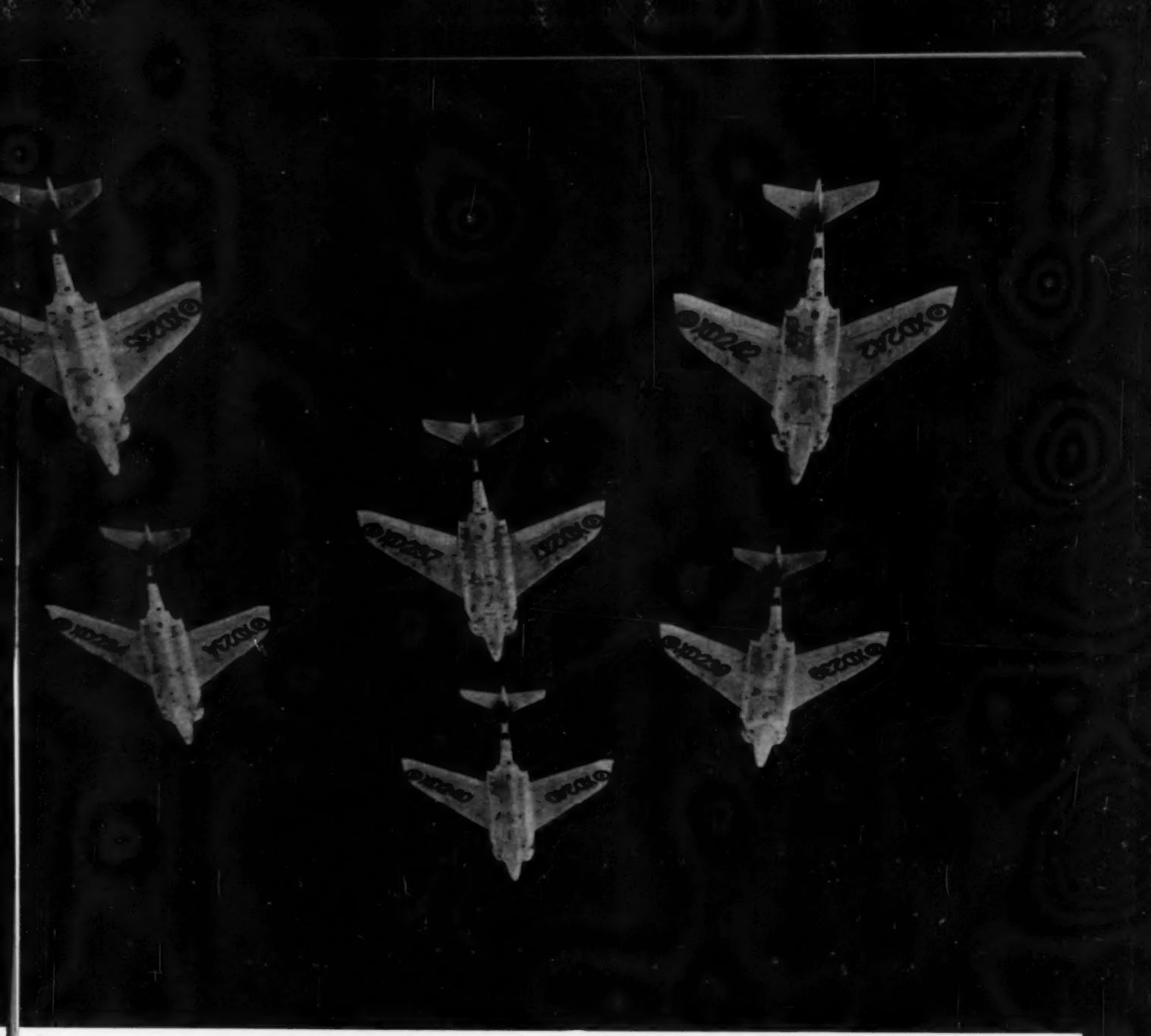


Left, the Fairey Rotodyne has a completely new main undercarriage, which retracts smartly and has special dampers to obviate any resonance; similar dashpots are provided on the nose gear. The Bristol 192 undercarriage (right) incorporates a pair of wheel oscillating and damping cylinders.



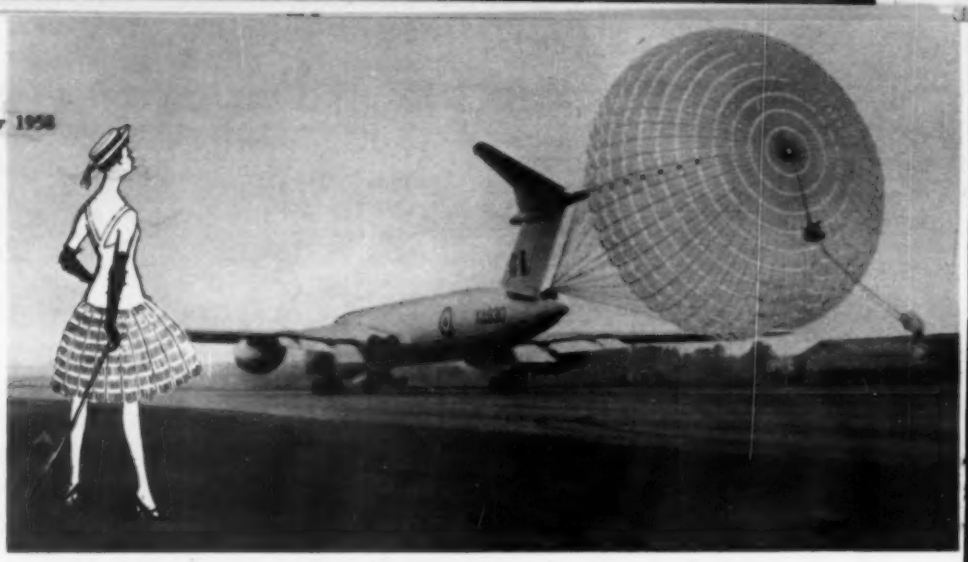
THE SCIMITARS OF "803"





One of the most enduring impressions of many Farnborough visitors will have been the spectacle of six Vickers-Supermarine Scimitar F.1 fighter/bombers of No. 803 Naval Air Squadron as they flashed low along the runway at near-sonic speed. Often these Naval blades were sheathed in vapour, as seen on the left; and towards the end of Farnborough-week "Flight" photographer Ian Macdonald was able to portray the same aircraft at a higher level, with the results seen in the three larger pictures. No. 803 Squadron will shortly be embarking in the Royal Navy's latest aircraft carrier—H.M.S. "Victorious."

EVE'S EYE VIEW



"Darling, all the parachutes got caught up in the aeroplanes and came trailing down behind them."

Darling Daphne, *September 7th*

I must tell you about the rather terrifying day I've just had. Had *you* ever heard of Farnborough? Well, nor had I until an absolute charmer at the *Gracious Living Magazine* party asked if I would like to see the Farnborough Show and said something about "all the latest models." And as we're all just longing to know what comes after the Trapeze of course I said "Yes."

Well, to my surprise, it turned out to be in the depths of the country, and after one of those rather dishevelling drives we found ourselves all amongst some bird-watchers with field glasses round their necks and waders and funny caps. But then I saw it was one of those out-of-door displays with heaps of *House & Garden* colours and rather an accent on aeroplanes, and Alistair (who came to the *Gracious Living* party with those two cissy interior decorators) made straight for rather a nice aeroplane in HOT CHOCOLATE and CLOUD and THAMES GREEN, with a sort of harvest festival display of shapes like asparagus and leeks, very effective, with great sort of vegetable marrows at the bottom. And I asked Alistair if he would say they were LIME GREEN and WHITE or was it rather more SHARP YELLOW? But Alistair didn't seem interested.

One thing struck me as very gay, the little GUARDSMAN RED ribbons fluttering from everything. Rather Spanish, I thought, but then so many people are going to the Costa Brava nowadays.

It's funny what daylight does to people, and Alistair didn't seem to have nearly as much conversation as last night. Although, come to think of it, perhaps I did do most of the talking. Anyhow, he said I might like to see Miss Ile's Park and as I do think one should support one's own sex as long as they aren't around too much, I had to agree.

Then he took me to the biggest tent, rather like the Chelsea Show, only smelling quite different, and said "Come to the caravan at three o'clock—No. 379 in the middle row," and simply disappeared. The tent was packed with the *most* disheartening people, all pushing along and breathing hard and quite unconscious of what was going on, and one was simply *swept* along, and suddenly one found oneself back at the door. Such a blessed relief and I can honestly say that the only thing that impressed me was the most handsome man, one of the exhibits, standing in the middle of acres of BITTER GREEN carpet biting a pipe. Darling, have you ever stopped to think what a pipe does for a man?

Well, it was still only half past two, so I struggled down endless steps and everyone seemed to be struggling up, and has it ever struck you how *terrible* everything is when there is more of it? I mean one ant is quite a nice little creature, almost a personality, but a horde of ants make your skin crawl, and the same thing goes for cows and sheep and even people. Or even more so.

So on I milled and suddenly I found I must have been moving in a queue and somebody said "Come along, please. Sit down," and pulled a black thing over my face and before I knew where I was there was the most terrific bang and my seat shot right up in the air, and there were deafening wolf whistles and I found that my new Party Whirl skirt had blown all over my face, but I *should* like to have been warned because my Can-Can petticoat is much prettier than the skimpy little number that I happened to be wearing. Anyhow, it seemed to be tremendously successful, though not perhaps in the nicest way. And as I was wondering how to end the act I found myself sailing down majestically, just like Charles Laughton in that delicious film where they kept winding him up and down the stairs in an invalid lift-chair. (And by the way, though I should hate to say so to the charming young man in charge I don't feel that this new model is going to be a *complete* success with invalids as the bang is just a *tiny* bit loud, let's face it.)

As you have probably guessed, I did find my way to the "caravan" and there was Alistair surrounded by glamorous men in the middle of the most contemporary *Indoor-Outdoor Living* set-up with the gayest striped blinds and patio furniture. And if one had a tiny criticism one would suggest that the actual caravan (yes, my dear, there *was* one, right in the middle of the OPEN PLAN) would have been better out-of-doors, perhaps among those lovely trees right away from the crowds.

Alistair gave me a drink, but he seemed terribly busy, so I started to chat to a rather grim young man, but we were constantly interrupted by the most horrifying roars, just aeroplanes flying by, but if *you* were planning a social event wouldn't you try to choose somewhere where there wasn't quite so much noise? Honestly, though, some of it was rather amusing, although I couldn't help feeling sorry for all the people milling about down below when they did a demonstration of Crowd Spraying. After all, one is used to being sprayed in cinemas and one or two of the crowd looked as though they could do with it but this *did* seem a little drastic.

Another thing that really worried me was the failure of the parachute demonstration. Darling, *all* the parachutes got caught up in the aeroplanes and came trailing down behind them, and I asked the grim young man what had happened to all those terribly brave parachutists but he seemed too upset to speak.

Some of the aeroplanes were really attractive, especially one little AUBERGINE number, and some of them looked just like the paper darts we used to make at school.

And, darling, Women again. One of the *very fastest* aeroplanes was flown by Lucy something-or-other *and* they said she was a terribly good pilot. Alistair was bumbling something about Lucy having an "e" in the middle and being a surname, but one couldn't hear because there was one rather old-fashioned looking aeroplane which hadn't even got a proper silencer and kept roaring by in the way one asks motor bike fans not to. The grim young man said "Surely that was a bang." And Alistair said rather primly, "It can't be, old boy, they're not allowed to." So whatever a bang is, it can't be if it isn't allowed. So like men.

I have come to the conclusion that Alistair is rather a man's man and not really interested in Gracious Living and I wasn't sorry when he said, "Mr. Fosdyke is driving his wife and baby and the twins back to London and he has very kindly offered you a lift." So I thanked Alistair and said that I thought some of the colours were very well chosen and the idea of putting a caravan right in the middle of the patio definitely EXCITING. But he only looked at me coldly and said, "It may interest you to know that you have just seen the deadliest aircraft in the world and just one of those 'vegetable marrows' you so much admired would turn this whole show into a heap of smoking ruins." "Well, in that case, it does seem an awful pity to make them, doesn't it?" I asked him. Alistair didn't say anything at all.

Darling, it's *terribly* late,

Bye for now,

PeeBee

Arnhem Land Aboriginal bark drawing.

Men of Skill and Experience

WALLY TOMS

Shell Fuelling Operator
At Kingsford-Smith Airport,
Sydney, Australia

ONE OF THE MEN RESPONSIBLE FOR SHELL WORLD-WIDE AVIATION SERVICE

SHELL

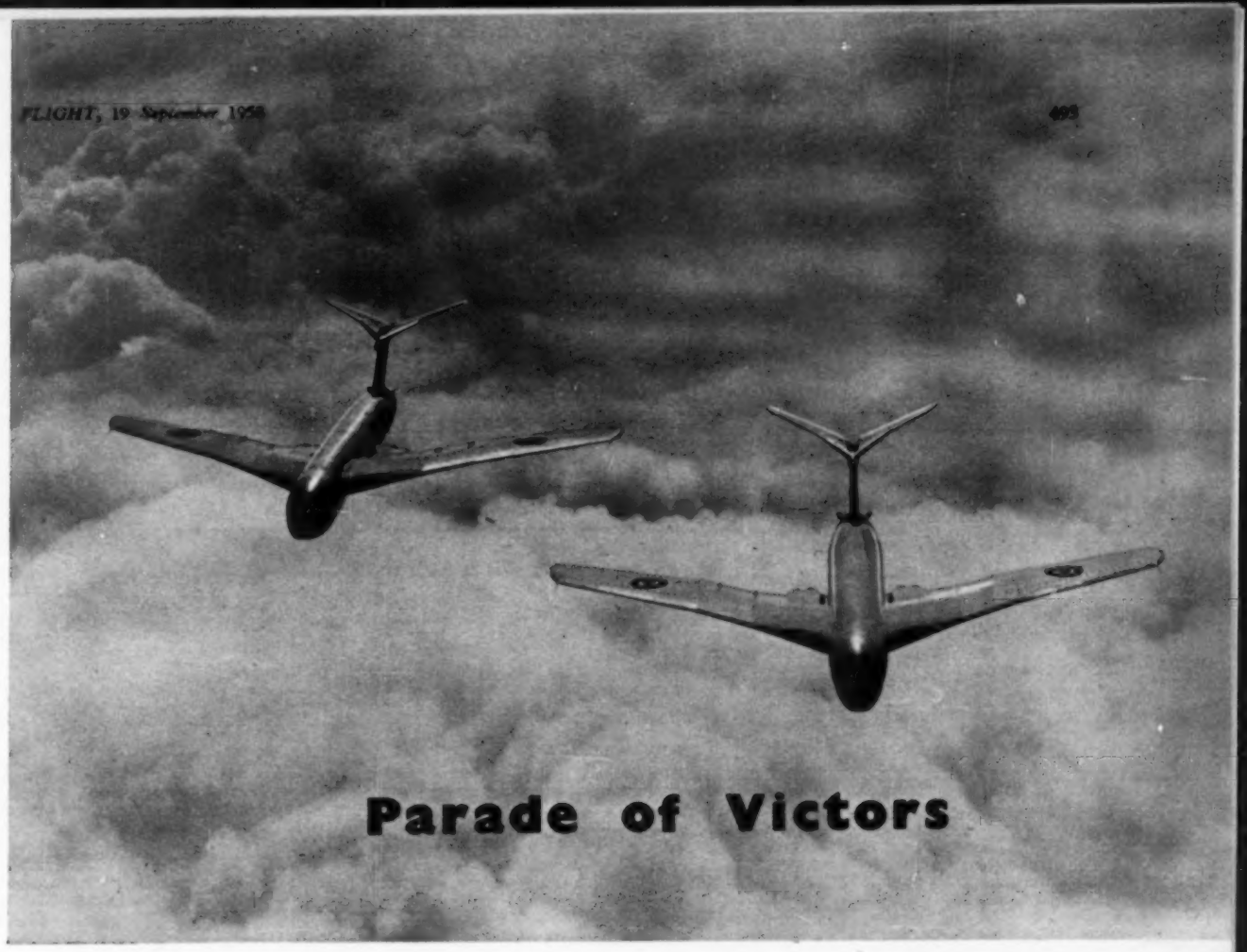
In quantity production

In quantity production for the United States Navy, Martin-Baker patent Mk.A5 and G5 fully automatic ejection seats are installed in the Grumman F9F-8T Cougar Trainer and the Chance Vought F8U-3 Crusader. Both of these seats are fully capable of ground-level ejection as successfully demonstrated at the U.S. Naval Air Test Centre, Patuxent River, on August 28th, 1957.

MARTIN-BAKER

AIRCRAFT COMPANY LIMITED

ENGLAND — CANADA



Parade of Victors

Eight Victors of No. 10 Sqn. lined up at their base at Cottesmore. Above, two of them in formation below the photographic Beverley.

No. 10 SQN. AT R.A.F. COTTESMORE

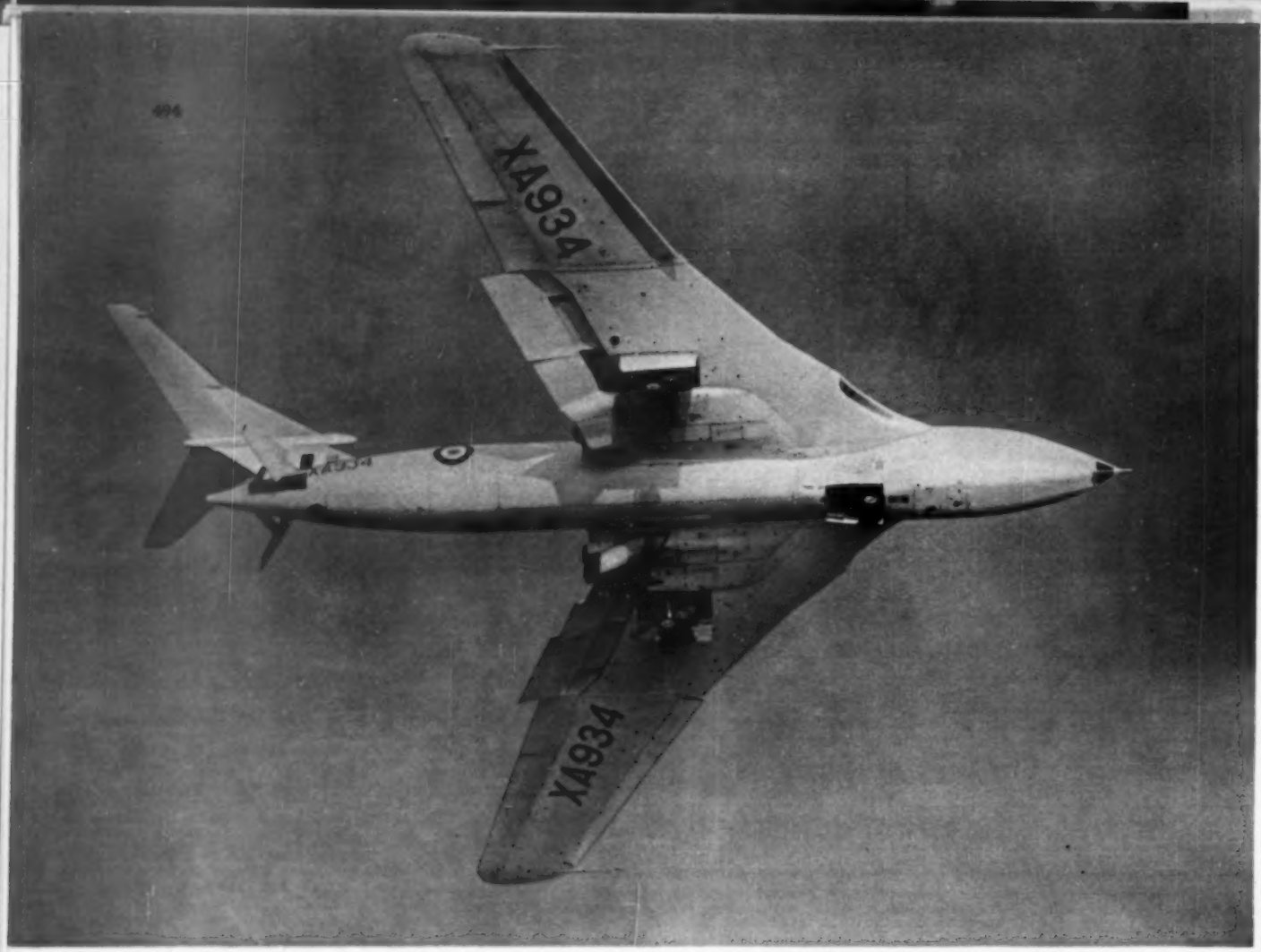
YET another great white bomber, the Handley Page Victor, is now established in squadron service. No. 10 Sqn. is at full strength, No. 232 O.C.U. at Gaydon is training crews, No. 15 Sqn. is forming, and some Victors have already joined a reconnaissance unit at Wyton. Delivery of Victor B.1s from the factory continues; and the Conway-powered B.2s will later follow them. A refuelling probe and underwing tanks, as seen at Farnborough, will soon be fitted to B.1s.

No. 10 Sqn. last week received the Press at its base at Cottesmore, Rutland, and showed off its new equipment and installations with very justifiable pride. Many of the pilots have flown one or both of the other V-bombers and some, including the commander, W/C. C. Owen, have served tours with U.S.A.F. Strategic Air Command. It is clear that the Victor is as well liked as any other V-bomber and that its performance is considered to be superior to that of foreign bombers—the B-52 included—in all respects except range. Indeed, at its operational height, the Victor is said to be capable of outflying and outmanœuvring any fighter in squadron service—certainly any fighter in R.A.F. service.

As more and more Victors become operational, Valiants will be increasingly applied to other rôles, such as that of tanker. The Victor naturally has a better chance of getting to and from a defended target. The particular technique of attack which has been developed as a result of the advent of nuclear weapons means that each V-bomber would go to its target alone and that the crew would be largely responsible for planning their own tactics and choosing their own approach. This places a heavy burden on the crew and makes training and independence of outside assistance of prime importance. There is, in fact, very strong emphasis on individual crew training and initiative and qualities of captaincy are regarded as even more important than actual flying ability.

Training of V-bomber crews is much more extensive than for any earlier type. Because of the length of training and because real bombing accuracy requires practice over a period of years, it is intended that V-bomber crews shall serve together for at

ILLUSTRATED WITH "FLIGHT" PHOTOGRAPHS



PARADE OF VICTORS . . .

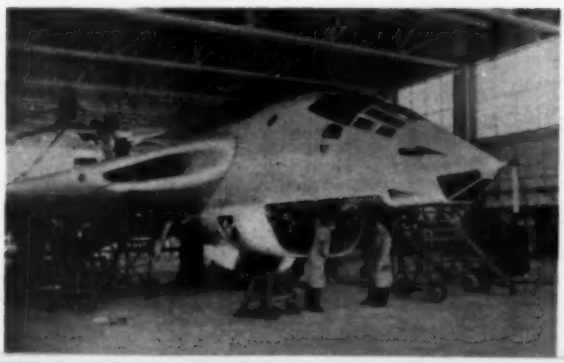
least five years. The groundcrews, too, are mostly regulars with special training and skills. Each aircraft has its own team, headed by the crew chief who virtually lives with his aircraft and even accompanies it on major overhauls. He flies with it whenever it goes to a distant base; and a sixth seat is being installed in all Victors to accommodate him. But Victors have not yet been abroad to any extent. One landed in Germany; another made a touch-and-go landing in Malta; but the first true foreign visit will be when A.V-M. K. B. B. Cross, the A.O.C. No. 3 Group, to which all Victors are attached, takes one to the S.A.C. annual bombing and navigation competition in California next month. Spares packs are now being distributed abroad to support Victors during foreign visits. Besides landing abroad during routine training, Victors will also make many prestige appearances because the deterrent must be advertised to achieve its desired effect. A.V-M. Cross said that "what matters is what you could do and how you show it before you do it." The force is something of a sinister shop-window and its standards are therefore very high.

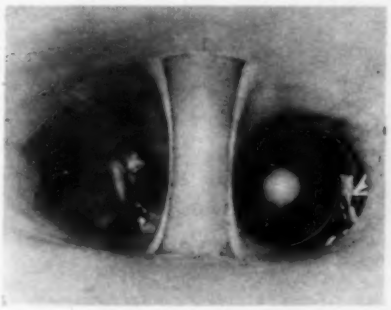
Both G/C. J. E. Johnson, Cottesmore station commander, and W/C. Owen strongly deprecated what they termed as circus tricks by specially stripped and lightly loaded V-bombers at Farnborough. Such antics had nothing to do with true operational flying and were definitely not part of normal squadron routine. Nevertheless, A.V-M. Cross, when questioned, was less downright and said only that he did not know whether the LABS technique would later be introduced for V-bombers. The U.S.A.F. have certainly practised the technique extensively with B-47s, but the future introduction into the R.A.F. of the stand-off bomb, with its ability to fly several hundred miles ahead of the bomber, would presumably make LABS unnecessary.

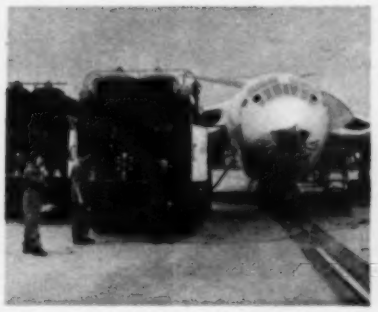
The Victor recently completed 1,000 hours of intensive flying in splendid style and serious troubles have been remarkably few. Last month a crack was discovered in a tailplane member during a routine inspection and was traced to stress corrosion. A new method of assembly was introduced and all tailplanes were removed and replaced. Some minor trouble was also experienced with braking parachutes which failed to stream, but this too is now largely overcome. The only restriction on flying seems to be connected with economies in flying hours designed to stretch the operational life-span of the aircraft as much as possible. A Victor crew generally flies one five-hour training mission each week and may additionally fly an air test or other secondary type of sortie.

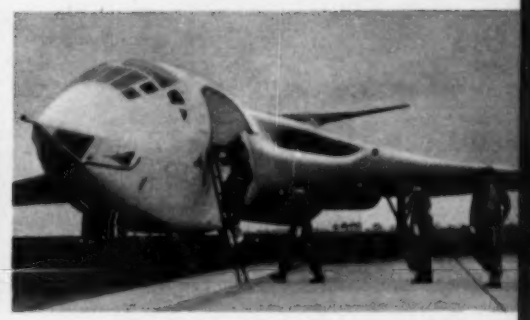
From the crew's point of view, the Victor has a great deal to

Victor maintenance from stem to stern being carried out in one of the large hangars. At left the tall Giraffe platforms are positioned to provide access to the tail while, at right, technicians inspect the ducting and equipment in the forward radome. The scanner is not visible. Note the "nostril" intakes, which have very small turbulators. The jettisonable hatches over the pilots' ejection seats are removed.









Left, a technician in stockinged feet inspects engine accessories far inside the intake duct of a starboard-outer Sapphire. In the centre view the aircraft is being refuelled from bowsers while a technician reports progress to the cockpit through the external intercom lead. Hydrants will later replace bowsers. At right, the crew climbs aboard through the shielded door which also serves for parachute exit.

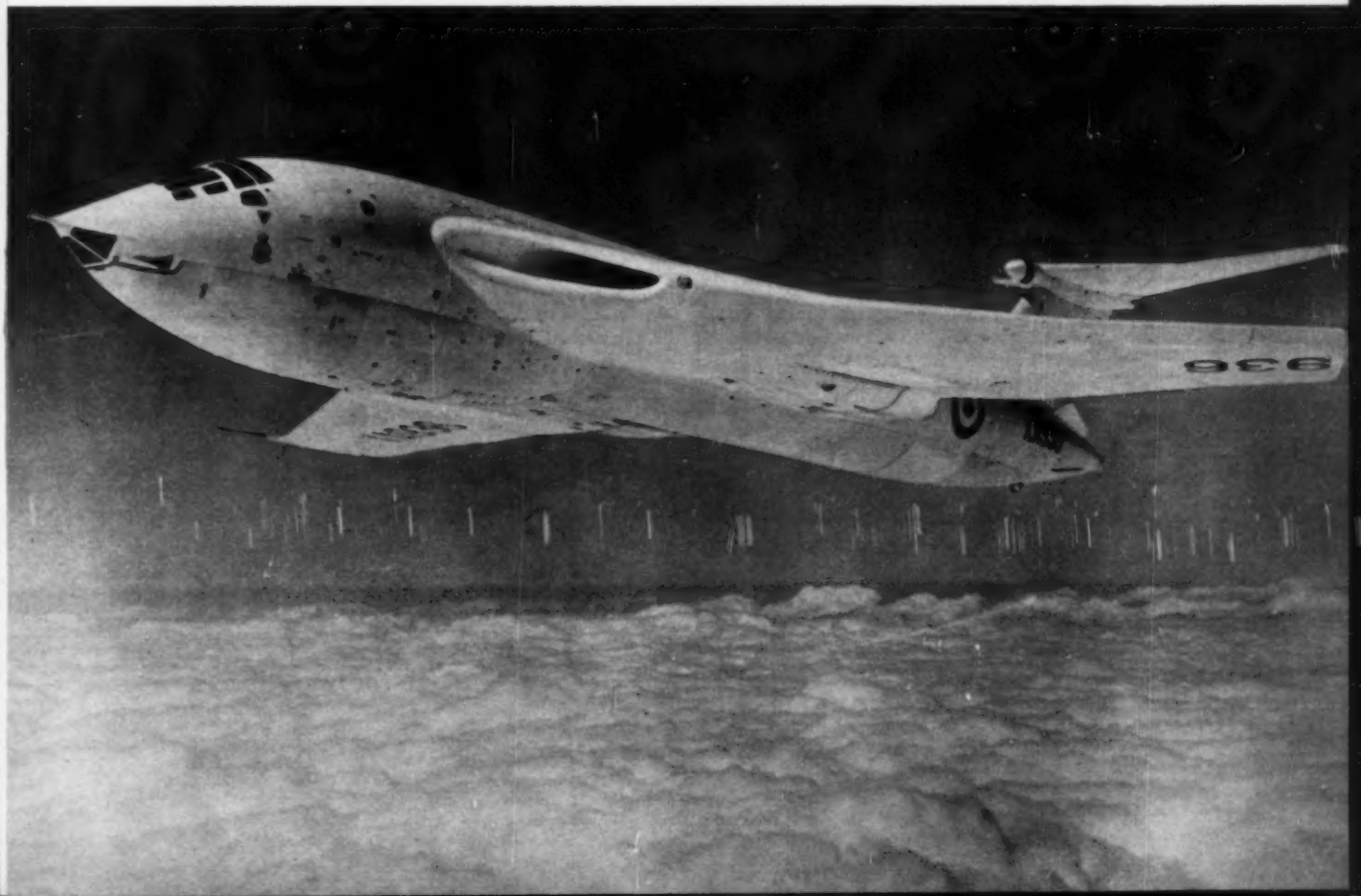
recommend it. Though neither wing-tips nor rear fuselage can be seen from the pilots' seats, the completely flush, electrically heated windscreen offers excellent visibility forwards and sideways. In the cockpit extensive use is made of miniature instruments; and only percentage r.p.m., exhaust temperature and oil pressure are indicated for each engine. These are placed centrally below the fire-warning panel and beneath them is a pull-out shelf containing most of the fuel system control buttons and switches. Only V.H.F. selectors and engine starting controls are mounted in the roof.

A gangway runs between the pilots' ejection seats to the visual aiming position in the nose and, since this does not permit any central control console, duplicated throttle and airbrake levers are provided outboard of each pilot. Flight refuelling, de-icing and heating, fuel proportioners, four-way trim and radio controls are on consoles beside the co-pilot, while bomb-door and flap controls are on consoles next to the captain. The spectacle control wheels are mounted on shafts emerging from the instrument panels; and the latter contain full blind-flying instruments plus Zero Reader and I.L.S. dials. The indicators for control-surface-position and hydraulic supplies are distributed on the coaming.

The whole cockpit floor is on the same level so that the three rearward-facing crew-members—navigator/plotter, navigator/radar operator and A.E.O.—are in fairly close contact with the pilots instead of being tucked away below and behind as in Valiant and Vulcan. In the middle of the floor between pilots and crew is a demountable swivelling seat, shortly to be replaced by a stressed, sliding seat for the crew chief. Equipment is very neatly disposed, producing an atmosphere at once spacious and intimate. This is considered very important to a sense of crew unity in the air.

Extensive preparation is required before any training sortie; and the navigators may begin to study their targets several days before take-off. More immediate briefings and other preparations would begin some 2½ hr before take-off and the crew would begin their final before-flight check 45 min before "wheels rolling." The engines would be started some 30 min later. If a very rapid get-away were required—for example, when a Victor is on alert status—all checks up to the point of engine starting would be completed well beforehand. The crew could then enter the aircraft and press the starter buttons immediately, making only final checks before moving off. Some nine hours normally elapse between the

The contrasting studies below and on the left, taken respectively from a Beverley and from the ground, show the Victor "clean" and fully "dirty." From either aspect it cannot fail to impress, both by virtue of distinctive aerodynamic form and glossy white coat. The latter No. 10 Sqn. makes a point of keeping scrupulously clean. The leading-edge flaps can be set to extend automatically at a certain airspeed.



Seconds after release of the braking parachute system, left, the extractor chute is drawing the main canopy from its container in the Victor tail-cone. The airbrakes are wide open. At right, G/C. J. E. Johnson, station commander at Cottesmore, right, confers with a Victor crew.

PARADE OF VICTORS . . .

beginning of final briefings for a five-hour sortie and the arrival of the crew in the mess for their post-flight meal.

Although the structure of both the wing and the tail of the Victor are no longer subject to security classification, little can be said about equipment and performance. It was plainly evident at Farnborough that the Victor handles almost like a fighter; and the squadron pilots speak very highly of its docility. The "self-landing" characteristic previously publicized is not for every-day use but, provided that the aircraft is properly managed, the landing is very simple and the very large ribbon parachute provides very considerable deceleration. Over the normal range of landing weights the touch-down speed varies between 125 and 140 kt, the exact value being in each instance calculated beforehand with a special slide-rule by the co-pilot. It is noteworthy that the leading-edge flaps may be set to extend automatically below a certain airspeed.

From the point of view of both maintenance and operational efficiency, the very large ventral bulge under the nose of the Victor provides excellent stowage for electronic and electrical equipment. The whole area may be easily laid bare and technicians can then walk right into the equipment space. Many black boxes are mounted almost at waist level. The steerable nosewheel is similarly accessible. Despite the lowness of this section, the bomb bay is high enough off the ground to obviate the need for any bombing-up pits, though an overhead crane is used to raise the weapons into the bay. All refuelling and defuelling connections are grouped in a single bay at chest level in the fuselage.

The excellent external finish of the Victor is largely accounted for by the special Handley Page corrugated stiffening and spot-welded skinning. Though this raises some repair problems, minor work can be performed on it at station level. The only need for large access ladders is at the tail, but particularly large removable panels make internal equipment easy to reach here also.

It can be stated that the Victor can be navigated with the aid of astro-fixes and Doppler radar and that it carries a comprehensive radar bombing system. The crew compartment can be pressurized at two levels, one for cruise and the other for combat.

Such features as a special operations block where crews can obtain all kinds of briefing and where full facilities are provided for the storage of flying clothing are now well-known. During last week's visit the electronics block was also laid open for inspection for the first time. This is a most impressive building in which large areas are fully air-conditioned and sound-proofed, and where most of the floors are always mechanically polished—not by "erks"—to keep down dust. All flight instruments, radio and radar, as well as various kinds of computer, are inspected and repaired; and special electronics stores are so arranged that equipment can be rapidly returned and issued without the usual triplicate form-filling. Full serviceability records are also kept.

Like all other V-bomber bases, Cottesmore has a 3,000 yd runway, 200ft wide, and a large number of specially constructed dispersal "pans." Each of these is equipped with a fuel hydrant, full electrical supplies and a telephone, and broad black tracks are marked on every taxiway to give unmistakable guidance for taxying aircraft. Full approach and airfield lighting is controlled from a central switch-board in the control tower, and all approaches and landings are directed from a single room in the control tower. Here, the approach controller sits at his C.R.D.F. panel and the G.C.A. director and talk-down controller sit beside him at the twin scopes of a Decca ACR.7. In addition, I.L.S. is available; and it is fitted as standard equipment in all V-bombers.

The Victor was the last of the three V-bombers to be ordered by the R.A.F. and was designed by a team headed by Mr. R. S. Stafford, technical director of Handley Page. The exhaustive aerodynamic study which led to the crescent wing-form was carried out by a team under Mr. G. H. Lee, while structural, aerodynamic and installation problems were Mr. C. F. Joy's responsibility. The first prototype flew at the end of 1952 and was followed in February 1956 by the first production aircraft. During a test flight over Hertfordshire last year, a production Victor "slipped" past Mach 1 and became the largest aircraft in the world known to have done so. It is not important whether it does so again or not, for even sub-sonically it still offers performance both in speed and ceiling as good as, or better than, that of any other large bomber in service. It is a welcome and potent addition to the retaliatory strength of this country and one which will serve well for many years to come. C. M. L.

Seemingly playing "follow-my-leader" round the winding taxiway at Cottesmore, three Victors head for their dispersal points. Each dispersal "pan" is equipped with refuelling hydrant, telephone and electrical supplies. Note the black guide-lines on the concrete.

Straight and Level

THAT respected British independent airline Hunting-Clan must have weighed very carefully the advantages and disadvantages of publishing—as it recently did—an outspoken attack on remarks in B.O.A.C.'s annual report about African Safari competition.

The situation, very briefly, is that Hunting-Clan and their Safari partners Airwork have built up cheap-fare business on African Safari services to such a degree—despite many handicaps—that B.O.A.C. have complained of diversion of their traffic.

Now you may think that an elephant might with equity complain about a mouse standing in its path. Though there is much more to the Safari controversy than this, may I just repeat two points which I have aired before? (1) Independents will gain nothing, and will probably lose much, by saying provocative things in public about the Airways Corporations. (2) There will always be unrest and suppression of enterprise—public and private—as long as we are content to muddle along without a national air transport *executive*.

● *"The tendency to price all categories of air transportation out of reach of a significant segment of the general public may signal a reversal of the recent diversion from surface to air travel and may constitute the first step towards a return to Government subsidy."*

This was said by Mr. G. Joseph Minetti, a member of America's C.A.B., when he dissented from the granting of a fare increase to the U.S. airlines. I wish we had public servants in this country whose job it was to stand up and say such things.

● I have not the honour of personally knowing Col. J. C. Nickersen, U.S. Army, but I am glad to see that he is to be restored to a full command position, with complete security clearance. The colonel, who has a distinguished record, was last year found guilty by a court-martial of having overstepped the mark in security in his dealings with the Press.

The reason I am glad is that I have long felt that the American system of security—or lack of it—places a wholly unwarranted strain on thousands of Senators, Secretaries, generals, engineers and anybody else with a high security rating. The "controlled leak" is surely one of the most dangerous and uncontrolled arrangements yet devised for the dissemination of information.

● My old friend Sir Charles Boost, chairman of Plummet Air Lines, is getting anxious about progress with Britain's supersonic airliner. "What the devil this committee thinks it's up to I just don't know," he snapped impatiently last week. "It's high time we were cutting metal. There's no time to lose if British air power is to regain the blue riband of the world's air routes."

Then from under his desk he produced the biggest brochure I have ever seen. "What d'you think of this, eh?" he beamed, pressing a button to turn the hydraulically operated pages. "It's the Scruggs S.A.469," he confided, "capable of 10,500 m.p.h. and powered by a mixture of rockets, ramjets, turbojets and enriched fusion reactors burning erotic fuels. It will fly the Atlantic in 20 minutes, or London - Paris in seven seconds, at fares lower than turboprops. The variable-geometry passengers are housed in individually refrigerated de luxe-class canisters. It's absolutely super, old boy—if only these blessed civil servants would get cracking with the lolly we could have it in service by 1962! Then we could replace all the big Yankee jets—they look like giving more trouble than they're worth anyway."

His eyes shining with excitement, he crammed on his Gosport flying helmet and with arms outstretched rushed round and round his office making a noise like a Gnome rotary.

"Sleeper-socks" are the latest come-on offered by T.W.A. during their overnight flights to New York. Here they are being modelled by two of T.W.A.'s English girls—Sheila Gayer, left, and Joan Williams. The combination of sleeper socks and English stewardesses is, I imagine, quite irresistible. Meanwhile B.O.A.C. on their Eastern routes have gone for a nice mixture of saris and oriental femininity, as illustrated in the charming line-up below, also quite irresistible.

● The sinking of the *Titanic* was a natural story for the cinema, and *A Night To Remember* did it justice. But there is another story which could make even greater cinema—the story of the airship R.101.

Was there ever such prodigious human creation more beset with technical problems or so bedevilled by the pressures of politics and prestige? In its blazing wreckage perished not only men who had exerted—and resisted—these pressures, but also men's dreams of a new aeronautical age.

I can see the opening of the film now. Awestruck young R.A.F. recruit, at Cardington: "What did they build this hangar for, sergeant?"

● Personnel managers have a pretty rough life in the aviation business. One tells me that he can never pick and choose: "The best men are always leaving, I can only get worse men to replace them and I never fire anybody." It makes one wonder where the best men go.

● A notice-board in front of the Hunting President 2 G-APMO in the static aircraft park at Farnborough read: "Built under contract to the Ministry of Supply and Civil Aviation." Could this be the first sign, at last, of the aircraft industry making an attempt to rationalize the Government?

● "Now this is the de Havilland Beaver. It can have wheels, or floats, or skis, or combinations. . . ."—From Oliver Stewart's 1958 S.B.A.C. Display commentary.

ROGER BACON

Mr. K. F. Topp (left), winner of the Helicopter Association's 1957 Alan Marsh Memorial Trust Fund Award, seen in a Hiller 12C with his Air Service Training instructor, Mr. W. H. Anderson. The purpose of the award is to provide rotary-wing experience to a helicopter engineering student, and Mr. Topp was selected from a number who had just completed their courses at the College of Aeronautics, Cranfield; he has now returned to Westland Aircraft.

THE INDUSTRY

Important Electronic Orders

DURING the Farnborough Show three important orders for electronic equipment were announced. From Marconi's Wireless Telegraph Co., Ltd., the Norwegian Ministry of Defence ordered two control and reporting stations and radars valued at £1m. These fall within the NATO infrastructure programme and include newly developed high-power radar transmitters mounted in completely self-contained housings. Both air- and water-cooling is employed, but the only external power required is a three-phase A.C. supply. The equipment is fully self-monitoring.

The second announcement concerned orders worth more than $1 million placed with E.M.I. Electronics, Ltd., for airborne radar equipment for the R.C.A.F. The contract was secured in the face of strong competition from United States and Continental companies and the equipment (which can also be used as a navaid) is to be installed in the Argus for long-range anti-submarine and reconnaissance work.

The third order announced came from Russia; it was for a Pye I.L.S. installation worth £40,000 for Moscow Airport.

A New Nimonic Alloy

INTRODUCTION of Nimonic 105, a new heat- and creep-resisting alloy in the well-known series of materials of that name, is announced by Henry Wiggin and Co., Ltd. A development of the nickel-chromium-cobalt-molybdenum Nimonic 100, it is stated to show a useful advance in high-temperature properties; it has greater resistance to creep at very high operating temperatures than Nimonic 100, the minimum life to rupture at 7 tons/sq in and 940 deg C being 50 hr.

An important advantage of Nimonic 105, state Henry Wiggin, is its improved resistance to a specific type of high-temperature corrosion sometimes experienced in gas turbines as a result of contamination by solid or molten sulphates associated with the combustion process. The new alloy has already been tested by the aero-engine industry and is now in production.

Servo Specialists

THE firm of Harvey Electronics, Ltd., has formed a new subsidiary, Servo Units, Ltd., at Farnborough, to handle their servo mechanism work. The new company will be taking over the manufacture of the existing range of Harvey servos, and its first new product will be a series of fully transistorized power servos giving stalled torque output of up to 5 lb ft.

One of the principal features of the new servos is that the mechanism will work from a single D.C. supply or alternatively from A.C. mains. The use of power transistors obviates the necessity of a vibrating relay; in addition, it is stated, the new series will be much less affected by high accelerations.

The directors of the new company are those of Harvey Electronics, Ltd., the electronics side being handled by Mr. J. P. Harvey, B.Sc., A.M.I.E.E., and the mechanical side by Mr. F. W. Shorter, A.M.I.Mech.E. The address of the new company is 273 Farnborough Road, Farnborough, Hants (Farnborough 1120).

Beryllium Production by I.C.I.

SHORTLY to be established by I.C.I. Metals Division is the first plant in Europe for the production of wrought beryllium. Designed to produce semi-fabricated forms of the metal, such as rod, tube and plate, and finished machined parts, the plant will have as its first task the execution of a production-scale contract placed with I.C.I. by the Atomic Energy Authority as part of a nuclear development project. Subsequent spare capacity may be made available for orders from other quarters, e.g., the aircraft industry. (Beryllium's low weight, high tensile strength and good heat-resisting properties—melting-point is 1,280 deg C—give it considerable promise in this field; already it is being used, according to reports, for part of the skin of the North American X-15.)

Handling and fabrication of beryllium require special techniques concerned with its particular metallurgical characteristics and from its toxic properties in certain compounds and forms. From research carried out by the U.K.A.E.A. stringent standards of operation have been evolved and codified, and the I.C.I. plant will incorporate the features found necessary for this purpose.

Unusual techniques are also involved in the manufacture of wrought forms of beryllium. The metal, which is received as flake or as small beads, is melted under vacuum in induction furnaces to produce an ingot. The latter, however, having a large grain-size and very poor workability, cannot be rolled or extruded directly, and has to be sintered before further processing.

Marconi's Wireless Telegraph Co., Ltd., have announced the appointment of Mr. Bernard F. Kane, O.B.E., B.Sc.(Eng.), M.I.E.E. (deputy chief of sales, radar division), as their sales and technical representative in Eastern Europe. Operating from Vienna, he will cover West and East Germany, Poland, Czechoslovakia, Austria, Hungary, Bulgaria and Roumania. Mr. Kane has a distinguished military and civil record as an expert in telecommunications and radar work.

IN BRIEF

Mr. L. S. Greenland, chief designer and director of H. M. Hobson, Ltd., has been appointed a Director of Integral, Ltd.

* * *

The aircraft division of Firestone Tyre and Rubber Co., Ltd., Brentford, Middlesex, have published an extremely informative brochure of technical data on their aircraft tyres. It includes notes on fitting and maintenance.

* * *

Immediately before the Farnborough Show, Kaylee Transfers, Ltd., executed a rush order of 60 transfers for the Westland Wessex demonstrated there. These included registration markings, company emblems, instructional markings and internal and external codings.

* * *

Palmer Aero Products, Ltd., announce that following a recently concluded licensing agreement with Parmatic Engineering, Ltd., of Ontario, Canada, they are now manufacturing filters which will be marketed under the name "Palmer-Parmatic." Filters of this type, which offer a wide choice of filter media, are fitted to the Avro CF-100 and Avro Arrow.

* * *

A series of four-day exhibitions (with lectures and film shows) devoted to the uses of nickel and its alloys is shortly to be held by Henry Wiggin and Co., Ltd. The first will be at the Royal Station Hotel, Newcastle-upon-Tyne, September 23-26; the second at the Metropole, Leeds, October 14-17; and the third at the Grand Central Hotel, Belfast, October 28-31.

* * *

In a reference to the Bristol 192 helicopter in our issue of August 29 the make of the transmission oil-cooler fan was incorrectly quoted. In fact—and as recorded in our detailed description of the aircraft on August 1—the two-stage fan is a product of the Airscrew Co. and Jicwood, Ltd., of Weybridge, Surrey, who also supply the centrifugal blowers for oil cooling on the Napier Gazelle engines.

* * *

Hepworth and Grandage, Ltd., of Bradford, have formally received from Claude Muncaster, R.W.S., R.B.A., S.M.A., R.O.I., a painting of the factory and its surroundings which they had commissioned from him. The painting will hang in the new offices opened as part of their jubilee celebrations last July. The famous landscape artist made his rough drawings from a helicopter and executed the detail work with the aid of aerial photographs of the city and the distant moorland country.

Club and Gliding News

FLYING club "at homes" are primarily outdoor social affairs; so if the weather is fine and warm half the organizers' battle is won. Such were the happy conditions the Oxford Aeroplane Club enjoyed on August 31; and as about 70 visiting aircraft turned up and the afternoon's display was interesting and varied, the occasion proved altogether successful.

Some of the visitors were agreeably exotic, notably a Falco F.8L, a Super Aero, an Emeraude, an Irish-registered Beechcraft Bonanza and a Piper Tri-pacer. The Falco and Super Aero (in the hands of Ernesto Zanlucchi and G/C. Edward Mole respectively) especially provoked envious glances; and the foreign visitation as a whole rather rubbed home our own lack of new light aircraft. However, two of the Rollason-built Turbulents at least showed that ultra-light aircraft are being built (if not designed) in this country, and a Thruxton Jackaroo helped to keep the home flag flying.

The display, with about eighteen items all told, was informatively compered by David Ogilvy. Though it is perhaps invidious to single out individual performances when so much was good, F/L. P. D. Austin's Chipmunk aerobatics deserve mention; they were not only well executed but beautifully positioned. A word of praise, also, to Mike Reilly for the accuracy of his jump from 4,000ft; and to Dr. Fox for performing so ably in the Bishop Tiger after being out of aerobatic practice for four years.

It was refreshing, too, to see the Mew Gull in which Alex Henshaw won the King's Cup before the war make sporting dashes across the field in the hands of the club chairman, Peter Clifford.

ON the occasion of the landing competitions of the Lancashire Aero Club tomorrow, September 20, a supper-dance is to be held at the Barton clubhouse. This is also the final day for entries for the club's Crossley navigation competition.

A SECOND flying scholarship for 1958 has been awarded by the Women's Junior Air Corps following donations from several firms based at Croydon Airport. The winner, Miss Pamela Ife, a 23-year-old secretary from Farnborough, Kent, will receive her flying instruction at Croydon Aero Club.

FAIR OAKS Aero Club is to hold its At Home and club competitions on Saturday, September 27, and its annual dinner-dance on Friday, October 17; tickets for the latter are 30s. The club has arranged a course for the Restricted R/T. Licence, beginning on October 29.

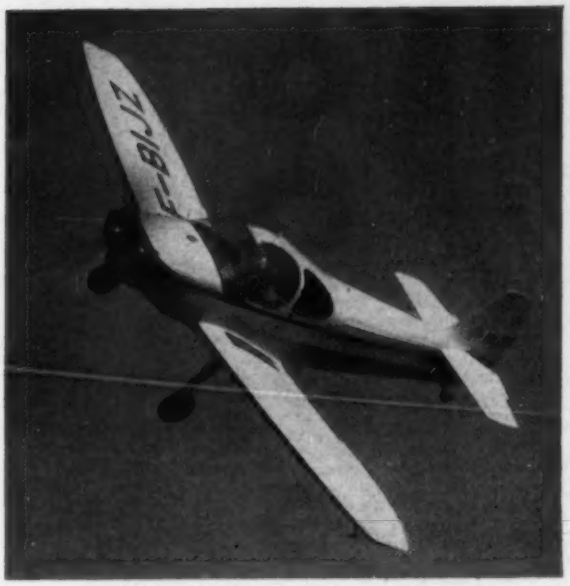
A RECENT visitor to *Flight* was Mr. T. A. L. Concannon, a member of the Kuala Lumpur Flying Club and the Royal Singapore Flying Club, and past vice-president of the Kuala Lumpur Club. During the past year (the year of birth of the new independent nation of Malaya), he reported, the four flying clubs at Kuala Lumpur, Ipoh, Penang and Singapore have been very well supported, and have logged a steady increase in flying hours. Royal Singapore, now partly subsidized by the Singapore Government, have recently added a Cessna 172 to their fleet, and are fitting radio to their Tigers.

Members of the Kuala Lumpur club, also, are enjoying a new type with the addition of a Chipmunk, the first low-wing machine to be available since before the war. The fleet now includes two Tigers, an Auster and the Chipmunk and, although the club now has no full-time instructor, all aircraft are in constant instructional use with the enthusiastic support of R.A.F. pilots stationed in Kuala Lumpur. A bursary scheme initiated by the club to train Malayans as pilots has met with good support, and first solos by local young men are becoming less of a rarity.

In Ipoh, the only gliding club in Malaya, the sport continues to attract old and new, Europeans and Malayans, and here again honorary instructors (mainly civilian) keep the training schedule —both power and gliding—moving smoothly. Dropping pay to tin mines and rubber estates in remote areas has kept members fully occupied since 1948, as it has for all the clubs; but, with the improvement in the emergency situation, pay drops are on the decrease.

Local pilots were getting ready to mourn the demise of the Penang club, down to one aircraft (an Auster Aiglet), when a redoubtable member set about infusing some new life with such success that the club, with one aircraft and only two pilots to tackle all the events, recently won the All-Malaya Dane Cup Rally from the holders, Royal Singapore, in an exciting contest at Sembawang, Singapore, with the Kuala Lumpur club as runners-up.

MORE than fifty C.P. 301A Emeraudes have now been produced by the French company Coopavia of 65 Rue de l'Industrie, Courbevoie, and the present rate of production is eight per month. Such optional equipment as full blind-flying instrumentation, 20-channel V.H.F. radio, range receivers and radio compass can be supplied; and the price for export to Britain varies between £1,900 and £2,200, excluding duty according to equipment. The sole agency for the sale of these aircraft in Britain is held by the Tricolore Trading Co., 36 Southampton Street, London, W.C.2.



The C.P. 301A Emeraude, referred to below.

SOME 600 flights have now been completed with the prototype Scheibe SF-23A Sperling two-seat high-wing monoplane. Designed in 1955, the Sperling (Sparrow) is intended for training, club flying and for the towing of sailplanes weighing up to 500 kg. Power is supplied by a Continental 90 h.p. flat four, but 85 h.p. or 65 h.p. Continentals, or the 65 h.p. Porsche aero engine, may be fitted.

The fuselage is made up of welded steel tube covered with fabric; and the wing, of NACA 23012 section, is of wood with a main and auxiliary spar. Eighty litres of fuel are carried in two wing tanks. The main undercarriage is sprung with rubber and the tailwheel is connected to the rudder and mounted on a leaf spring.

The Sperling is stressed for aerobatics and the seats are dished to accommodate parachutes. Left-hand throttles are provided, and the aero-tow fitting, mounted above the tailwheel, has a release lever between the seats. The machine conforms to German airworthiness categories S4K and R3.

Leading data are: span, 32ft 5in; length, 20ft 4in; wing, 12.16 sq m; empty weight, 920 lb; maximum gross weight, 1,625 lb; maximum wing loading, 61 kilograms/sq m; maximum speed, 125 m.p.h.; cruising speed, 110 m.p.h.; landing speed, 47 m.p.h.; service ceiling, 21,400ft; take-off run, 460ft.

DERBY AVIATION, operators of Elstree Flying Club, are starting a course of subjects—for members of any club—including navigation, meteorology, aviation law and flight planning, up to Commercial Licence standard. Lectures will be held each Tuesday for 32 weeks from 10 a.m. until 4.30 p.m., starting on October 28. Cost of the course is £75. Enquiries should be addressed to the manager, Elstree Aerodrome, Herts.

FLYING has begun again at Sherburn-in-Elmet with the commencement of a three-month lease by the Halifax Gliding Club. The club began operations last month at Sherburn with its T.31 Tandem Tutor and a number of powered aircraft are also to be based there. Plans are being made for the formation of a Popular Flying Association group at the aerodrome.

METEOROLOGY for glider pilots is the subject of a course of eight lectures to be given next month at the Kronfeld Club by Dr. R. S. Scorer and Mr. C. E. Wallington. Intended primarily for those interested in flying and in particular in soaring, the course requires no previous knowledge of meteorology, but some knowledge of physics will be useful. The latest research results in the study of mountain waves and of convection will be described, together with the basic principles used in weather forecasting. The lectures will be given fortnightly beginning on October 2 at 7 p.m., and further details are obtainable from the British Gliding Association, Londonderry House, 19 Park Lane, London, W.1. The fee for the complete course is 10s, payable in advance, and for single lectures the fee is 2s, payable at the door.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

The Croydon Closure

THE decision of the Ministry of Transport and Civil Aviation to close Croydon Airport causes my co-directors and myself considerable concern. Our company, and many others operating private aircraft specifically for the purpose of furthering home and export business, must have the use of an airfield near London in order to operate with speed and efficiency.

With the closure of Hendon and Northolt, Croydon is the only airfield available to us which is within easy reach of London.

Apart from this, Croydon Aerodrome is regularly used by commercial operators, by ambulance services, by the Press, by flying clubs and, ironically enough, by the R.A.F. and U.S.A.F. as an alternative landing ground when poor weather conditions prevail at Gatwick.

So far no suitable alternative is proposed. Surely the Minister of Transport and Civil Aviation should think again before prejudicing the efficiency of industries already handicapped by bureaucracy, and hamstrung by taxation.

Meltham, Huddersfield.

DAVID BROWN INDUSTRIES, LTD.,
David Brown, Junior, Director and General Manager.

Pilots' Flying Hours

MANY fantastic claims are made from time to time of the total flying hours achieved by some pilots. You may be interested in the enclosed cutting from an Australian local newspaper in which a claim of over 70,000 hours' flying is made by a London correspondent in respect of Tim Wood, Blackburn's chief test pilot. The correspondent is obviously very much astray with his figures.

It was, however, recently noticed that your columnist, Roger Bacon, on his "Straight and Level" page, stated that many pilots throughout the world have compiled some 40,000 to 50,000 hours' flying. It is my impression that no pilot has yet exceeded 30,000 hours; and when bearded Capt. O. P. Jones retired from B.O.A.C. after a life-time of service on regular routes, he had, if I recall correctly, some 23,000 hours—which, at the time, was thought to be a record.

Perth, W. Australia. K. D. COHEN,
Operations Manager, MacRobertson Miller Airlines, Ltd.

That Terminal "s"

ON the subject of the use of the final "s" in referring to company names (raised recently by Roger Bacon in "Straight and Level") the words "Bristols" and "de Havillands" are, of course, contractions of the phrases "Bristol's aircraft factory" and "de Havilland's aircraft factory" (I am not suggesting that these are the registered titles of the organizations concerned, merely that when we say "Bristols" or "de Havillands" we are referring to their respective aircraft-building companies). In the contraction the apostrophe is left out and we thereby forget that the "s" indicated possession.

The addition of an "s" without its apostrophe is now usual by business houses of all calibres, thus the local general store may now have on its nameboard "Browns", whereas fifty years ago the title would have been "Brown's General Store". In the same way "Lloyd's Bank" has for many years now been officially "Lloyds".

If a further contraction is made and the "s" is omitted from "Bristols" and "de Havillands" you will find that in the first instance confusion with the city of Bristol will arise and in the second confusion with particular members of the de Havilland family.

It so happens that the main American companies can leave out the "s" without causing confusion because names of cities or regions are seldom involved, or, as in the case of Douglas, the apostrophe and the "s" would make pronunciation difficult.

I think that the size of the organization also has something to do with the omission of the "s". It seems that when employees are numbered in tens of thousands and one man no longer holds the reins then the organization is, for example, no longer "Mr. Douglas's aircraft factory", but "Douglas".

Sheffield, 2. A. B. FAIRBROTHER.

"Doodler's" Disclaimer

IT is most pleasing to read the letters of Mr. K. W. Marshall and Mr. Maurice Austin regarding my paintings of aircraft which are appearing in the pages of *Flight*.

I must, however, disclaim one honour done to me by Mr. Austin. Far from having been an art master, I have never had any art training whatsoever. I am merely a spare-time doodler with a good memory, an observant eye and an intimate acquaintance with aeroplanes in the air, on the ground and in the factory for longer than I care to remember.

I would also like to point out that the text of *The Clouds Remember* was written by Major Oliver Stewart, M.C., A.F.C., whose vast experience as a distinguished fighter pilot and an experimental test pilot in World War I fitted him so well to describe in his own inimitable way the 48 types illustrated, most, if not all, of which he had flown in the course of his Service career.

London, W.1. LEONARD BRIDGMAN.

Pyrotechnic

APROPOS your penultimate paragraph in "Straight and Level" of August 29 [Roger Bacon's comment about the first rocket to the moon], I was passing a "dumb newsboy" stand outside London Airport a couple of weeks or so ago on which the poster heading read: U.S. MOON ROCKET DISINTEGRATES.

Below the poster was the newspaper advert., which announced: GET YOUR STAR HERE, 2½d.

Hounslow, Middx. K. RICHARDSON.

Derby Aviation—Pictures Wanted

THIS group of companies will celebrate its coming-of-age next year, and we are in the throes of preparing a suitable booklet to cover in illustrated form its past, present and proposed future. However, suitable photographs of the early days seem to have strayed, and if any reader is able to lend us a picture or pictures of the R.A.F. Harts or Hinds with which the first school was originally equipped in 1938, preferably showing some aerodrome buildings that definitely pin-point the base as Derby (Burnaston), I will personally ensure that anything sent is returned as quickly as possible.

Elstree Aerodrome, Herts. DERBY AVIATION, LTD.,
David F. Ogilvy, Manager (Elstree).

FORTHCOMING EVENTS

Sept. 15-21. Battle of Britain Week.
Sept. 21. B.G.A.: National Sailplane Aerobatic Contest, Dunstable.
Sept. 21. Denham Flying Club: Garden Party.
Sept. 21. Royal Belgian Aero Club: 900 cu m Balloon Competition.
Sept. 21. Milan Aero Club: Rally.
Sept. 22-27. A.C.I.M.A. Third European Aeronautical Conference, Brussels.
Sept. 25. R.Ae.S. Graduates' and Students' Section: "The Next Generation of Civil Aircraft," by G. H. Lee.
Sept. 25-26. Aerodrome Owners' Association: Annual Conference.
Sept. 26-29. Austrian Aero Club: Innsbruck Rally.
Oct. 9. Society of Instrument Technology: "Aircraft Flight Simulators," by Dr. A. E. Cutler.
Oct. 10-11. College of Aeronautics, Cranfield: Open Days.
Oct. 16. R.Ae.S. Graduates' and Students' Section: "The Fatigue of Aircraft," by Major P. L. Teed.
Oct. 16-17. British Interplanetary Society: Space Medicine Symposium and Twenty-fifth Anniversary Dinner.
Oct. 20-29. AGARD meetings, Copenhagen.
Oct. 23. British Institution of Radio Engineers (Scottish Section): "Flight Evaluation of Airborne Electronic Equipment," by H. G. Hinkley (at Glasgow).
Oct. 29. R.Ae.S. Graduates' and Students' Section: Annual Film Show.
Nov. 11. R.Ae.S. Graduates' and Students' Section: "The Air Transport Auxiliary," by Sir Gerard D'Erlanger.
Nov. 28. R.Ae.S. Graduates' and Students' Section: Annual Dance.
Dec. 9. R.Ae.S. Graduates' and Students' Section: "The Future of the British Aircraft Industry," by E. C. Bowyer.

R.Ae.S. Branch Fixtures:—Sept. 22, *Henlow*, a.g.m. and film show. Sept. 23, *Luton*, film evening. Sept. 24, *Manchester*, "Why Airlines are Hard to Please," by B. S. Shenstone. Sept. 30, *London Airport*, "The Boeing 707," by M. Pennell. Oct. 6, *Henlow*, "Mixed Powerplants," by M. J. Brennan. Oct. 8, *Manchester*, "Problems of Supersonic Flight," by L. P. Twiss; *Weybridge*, "Physiological Aspects of High-performance Flight," by Dr. K. G. Williams. Oct. 21, *Luton*, "Fatigue Testing of the Fokker Friendship," by E. J. van Beek. Oct. 29, *London Airport*, brains trust; *Weybridge*, brains trust. Nov. 4, *Luton*, "Guided Flight," by L. H. Bedford. Nov. 12, *Manchester*, "Digital Differential Analysers," by K. V. Diprose. Nov. 18, *Luton*, Discussion Evening. Nov. 19, *Weybridge*, "Training of a Production Engineer for the Aircraft Industry," by Professor J. Loxham. Nov. 21, *Luton*, Annual Dinner. Dec. 2, *Luton*, "Satellites," by E. M. Dowlen. Dec. 4, *London Airport*, "Airline Operational Flying," by Capt. W. Baillie. Dec. 10, *Manchester*, "Civil Aircraft Production," by P. Imlach; *Weybridge*, R. K. Pierson Memorial Lecture, by B. S. Shenstone. Dec. 19, *Weybridge*, Annual Dance.

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If you have a production application demanding zero backlash and low friction characteristics we should be pleased to investigate and advise.

The illustration is shown by the courtesy of H. M. Hobson Limited.

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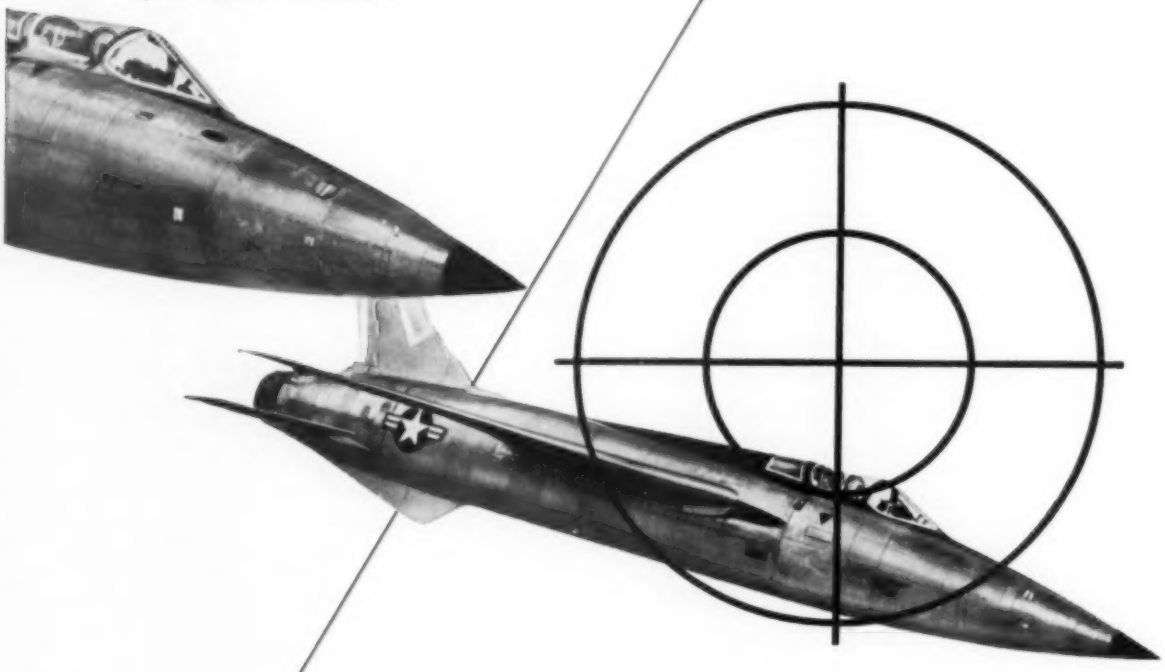


REPUBLIC AVIATION

FARMINGDALE, NEW YORK, U.S.A.

Designers and Builders of the Incomparable THUNDER-CRAFT

SERVICE AVIATION

Royal Air Force and Naval Flying News

"Flight" photograph

The first of the Fairey Gannet AEW.3 carrier-borne early-warners for the Royal Navy, flying on one half of its Armstrong Siddeley Double Mamba (of a more powerful sub-series than installed in earlier Gannets).

Air Commodore Appointment

NEWLY appointed A.O.A. at 2nd T.A.F., with the acting rank of air commodore, A. Cdre. (formerly G/C.) J. B. Voyce commanded No. 139 Sqn. in the P.F.F. and with this squadron—equipped with Mosquitos—won the D.F.C. in 1944 and a Bar to it the following year. He has for the past three years been Senior Administrative Officer at H.Q. No. 11 Group, Fighter Command.

R.A.F. at Dunstable

THE R.A.F., now building up a strong team for the 1959 National Gliding Championships, will have three entries in the aerobatic gliding contest at Dunstable next Sunday, September 21.

The R.A.F. entrants, who will all fly the new Olympia 419s, will be W/C. N. W. Kearon, of Bomber Command, deputy chairman of the R.A.F. Gliding and Soaring Association; F/L. B. B. Sharman, of R.A.F. Andover; and Sgt. Andrew Gough (this year's winner of both the R.A.F.G.S.A. championship and of the London Region Section of National Gliding Week), who is now with 2nd T.A.F.

A.T.C. Gliding Schools

THREE new week-end gliding schools for the Air Training Corps are about to open in Cornwall, Gloucestershire and Bedfordshire, and a fourth—in County Durham—will be ready for pupils at about the beginning of September. The new schools are at R.A.F. stations St. Eval, Cornwall; South Cerney, near Cirencester, Glos; Henlow, Beds; and Middleton St. George, near Darlington, Co. Durham. Altogether, six new schools have been promised for the A.T.C., bringing the total up to 26—plus a whole-time gliding centre which operates at R.A.F. Hawkinge, Kent. A second whole-time centre (for squadrons in Scotland and the North of England) will be ready in September or October at R.A.F. Newton, Notts. Formation of the six new week-end schools and the additional whole-time centre will allow a further 800 cadets to be trained annually up to solo standard. In the year ended May 31, 1,435 cadets gained gliding proficiency certificates.

Model Aircraft Contest

WHEN the annual R.A.F. Model Aircraft Championships were held at R.A.F. Debden on August 30 and 31, some 240 competitors from the nine U.K. Commands took part in the 22 different contests. Weather conditions were perfect and as a result there were some first-class flights. The Victor Ludorum Trophy went to Cpl/Tech. Irvine of No. 90 Group, for his victories in the control-line *concours d'elegance*, aerobatic and speed handicap contests; Flying Training Command won the Inter-Command Challenge Trophy; and the Apprentices and Boy Entrants Station Shield went to R.A.F. Halton.

At the prizegiving the president of the R.A.F. Model Aircraft Association, A.V-M. G. B. Beardsworth, said that although it had shrunk a little since last year there were still over 90 clubs affiliated—the latest being one at Christmas Island. Contestants had come to Debden from all home Commands, and during the past year the competition secretary, S/L. Cable, had led an R.A.F. team in the national championships.

Recent Appointments

AMONG recent R.A.F. appointments announced by Air Ministry are the following:—

G/C.s T. E. J. Fitton to Air Ministry, for duty in the Department of the Air Member for Supply and Organization; R. F. L. Hart to H.Q., Flying Training Command, for administrative staff duties; A. Hughes to Warsaw, as air attaché; H. P. Johnston to H.Q., No. 24 Group, for air staff duties; B. Samson to Air Ministry, for duty in the Department of the Air Member for Supply and Organization.

W/C.s S. J. Bryant to Air Ministry, for duty in the Department of the Air Member for Supply and Organization (with acting rank of group captain); H. Bamforth to R.A.F. Innsworth, to command; J. Eames to Air Ministry, for duty in the Department of the Air Member for Personnel; L. B. Fletcher to Air Ministry, for duty in the Department of the Air Member for Supply and Organization; F. Healey to R.A.F. Sylt, for technical duties; P. W. Jamieson to Ministry of Defence; R. F. Jones to H.Q., Air Materiel Command, U.S.A.F.; F. J. Mowbray to Ministry of Supply; J. R. Musgrave to H.Q., Bomber Command, for training duties; D. A. Oxby to R.A.F. West Raynham, for operations duties; E. B. Panter to A.A.F.C.E., for staff duties; J. B. Quarrington to Air Ministry, for duty in the Department of the Air Member for Supply and Organization; A. Stevenson to R.A.F. Akrotiri, Cyprus, to command No. 3 (Light Anti-Aircraft) Wing, R.A.F. Regiment; A. M. Taylor to R.A.F. St. Athan, to command the Administrative Wing; J. E. Tipton to R.A.F. Staff College, Bracknell, for directing staff duties; C. H. Wiggins to Air Ministry, for duty in the Department of the Air Member for Personnel.

S/L.s B. Hamilton to H.Q., 2nd T.A.F., for air plans duties (with acting rank of wing commander); R. M. Morton to Air Ministry, for duty in the Department of the Air Member for Supply and Organization (with acting rank of wing commander).

Reviewing officer at the passing-out parade of the 46th intake at the W.R.A.F. OCTU at R.A.F. Hawkinge was A. V-M. J. G. Franks. The Sash of Merit was awarded to P/O. J. Doyle (centre), and among other W.R.A.F. officers in the parade was the air vice-marshal's daughter, P/O. R. A. Franks (left).

IN BRIEF

The bells of the R.A.F. church, St. Clement Danes, were heard again on September 4 for the first time since the church's restoration.

* * * * *

After undergoing a two-year modernization programme, the aircraft carrier H.M.S. *Centaur* re-commissioned at Devonport on Sept. 3.

* * * * *

No. 600 (City of London) Sqn. Association is to have a tent at the R.A.F. Biggin Hill "at home" tomorrow—Battle of Britain Day (September 20). The Association states that all members will be welcome.

* * * * *

No. 85 Sqn., R.A.F., is to hold its thirteenth annual reunion at Victory Ex-Services Club, London, Nov. 15. Tickets (14s) from J. Roberts, 60 Swanfield Road, Waltham Cross, Herts.

* * * * *

R.A.F. Felixstowe, which was established as an R.N.A.S. base in August 1913 and as an R.A.F. base in April 1918, is to receive the freedom of Felixstowe at a ceremony on September 26.

CIVIL AVIATION

8,000 MILES IN A DAY

THE de Havilland Comet has made many spectacular flights in the past nine years, but never one quite so impressive as last Sunday's from Hongkong to Hatfield. Taking off at sunrise from Kai Tak's new runway (the ceremonial inauguration of which on September 12 was one reason for the Comet's visit), Comet 4 G-APDA landed at Hatfield two hours before sunset. Total distance was 7,925 st miles, covered in an elapsed time of 18 hr 22 min —an average block-to-block speed of 432 m.p.h. Average cruising speed was 487 m.p.h.

Two refuelling stops were made, the first at Bombay (1 hr), the second at Cairo (1 hr 6 min). In command of the round trip was de Havilland's chief test pilot John Cunningham. On board were 33 D.H. and B.O.A.C. passengers and crew-members, including Capts. Cane and Alabaster of B.O.A.C., and Mr. Basil Smallpeice, the Corporation's managing director.

The flight was one of a series of world proving trials which the Comet 4 is making as part of its airworthiness certification tests. These call for 100 hr of flying under route conditions: the next flight was due to begin last Wednesday, when the same aircraft was expected to leave Hatfield on a ten-day flight to Canada, the U.S.A., Central America and South America. The provisional programme, not confirmed as *Flight* went to press, called for visits to the following places: Ottawa (via Gander); Toronto (D.H. Canada, Downsview) and return to Ottawa; Vancouver (night stop); Mexico City (night stop); Lima (night stop); Buenos Aires (night stop); Rio de Janeiro; Caracas (night stop); New York. Thence, on Saturday, September 27, non-stop home to Hatfield.

When this flight is completed the Comet 4—having completed the rest of its airworthiness programme—will qualify for its certificate of airworthiness, which on present form should be granted before the end of this month.

Last Friday, B.O.A.C. took advance-delivery of the second production Comet 4, G-APDB, complete with a provisional airworthiness certificate for crew-conversion training purposes. The first aircraft has already been giving B.O.A.C.'s jet pilots initial training during tests from Hatfield; DB will concentrate on this work at Stansted and Bedford airfields, to avoid A.T.C. disruptions at London. (A note on the number of jet flying hours which will be completed by B.O.A.C. Comet pilots appears on page 505.)

A precise date for the inauguration of B.O.A.C.'s transatlantic Comet services has not yet been officially announced: possibly *Monarch* services will begin on November 14. (For PanAm's 707 plans see page 505.) Mr. Smallpeice said also that the scheduled Hongkong - London Comet 4 time, in May 1959, will be about 22 hr, cutting 10 hr off the existing Britannia schedule.

Footnote: The Comet 4 was in the news again last week when D.H. inspectors discovered a deliberately sawn-through leading-edge rib on the seventh production aircraft. A statement by de Havilland said: "The management considers the incident was probably the result of an action by an employee with a grudge against either his workmates or the company. The police have been informed."

HOW TO BEAT RECESSION

THE following statement is taken from an annual report of B.E.A.: " . . . the biggest single factor which stimulated the growth of domestic traffic during the year was the introduction of an £8 'winter weekly return' fare between London and Glasgow and between London and Edinburgh. The public reaction was remarkable and encouraging. During the ensuing five months the number of passengers carried increased by 153 per cent . . ." The year to which this referred was 1952.

The two men most concerned with the D.H. Comet 4's record flight from Hongkong earlier this week are seen disembarking a few moments after touchdown at Hatfield. They are, left, John Cunningham, D.H. chief test pilot, and Mr. Basil Smallpeice, managing director of B.O.A.C., who announced that the Corporation expects to start transatlantic Comet services to New York on November 14.

Behind the introduction six years ago of an £8 return fare was the fact that B.E.A. aircraft were maintained at Renfrew, a process that involved a considerable amount of ferry flying. Under these conditions even the lowest fares would be profitable. But when the engineering base at Renfrew was abandoned in 1955 and the ferry flying came to an end, it was no longer economical to retain such attractive rates.

Recently B.E.A. has had a different situation to face. Traffic on domestic services last winter showed only a marginal rate of increase. Although London - Glasgow traffic rose 11 per cent above the previous winter's level, on the London - Edinburgh and London - Belfast routes the increase was only 1 per cent, while London - Manchester traffic actually fell by 7 per cent. The Corporation's response—coming appropriately after the chairman's recent utterances on the need to cut fares if traffic growth was to be maintained—has been to introduce excursion return fares valid for weekend travel in the winter months. The round trip from London to Scotland or Northern Ireland can now be made for £8, while the new return fare London - Manchester is £5 10s. These will save about 40 per cent on the normal tourist fares.

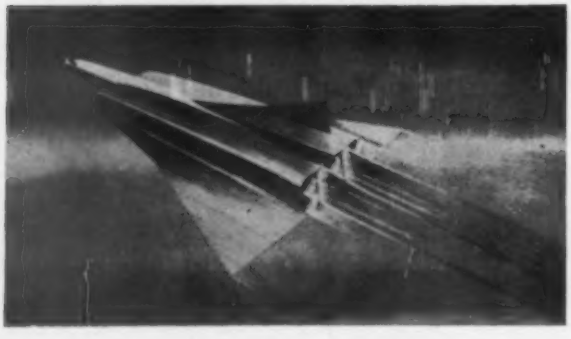
CAMBRIAN'S DAY OF RECKONING

DESPITE the progressive deterioration of airline traffic throughout last winter, Cambrian Airways opened the year by forecasting a traffic increase in 1958 of 15 per cent. The airline planned for a rise from 58,000 to 70,000 passengers, over half the growth coming from an expansion in Channel Island traffic (from 40,000 to 46,000) To cater for this anticipated growth, an extra Heron had been ordered and plans were made for an increase in the number of pilots from 18 to 21.

In the event, the forecast has proved quite unrealistic. The overall level of British traffic has changed little from last year while traffic to the Channel Islands has fallen sharply. As a result Cambrian have had to cut back their programme sharply. The Heron on order will not now be required and the existing fleet of three Herons will be sold. All Cambrian's scheduled services will be operated by the two remaining DC-3s. Fourteen employees are to be dismissed, and the number of pilots reduced to 14.

It will be recalled that, last February, B.E.A. acquired a 33 per cent share in Cambrian.

In the news last week was Bristol Aero-Engines' tentative project for a Mach 3, 150-passenger supersonic airliner. This sketch shows the arrangement of the mixed ramjet-turbojet powerplant. Operation from conventional runways is claimed to be possible. Fuel would be used as the aerodynamic-heat sink.



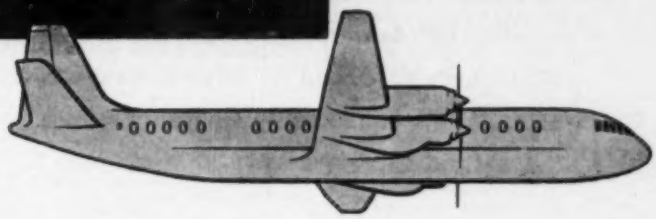
INSURING THE JETS

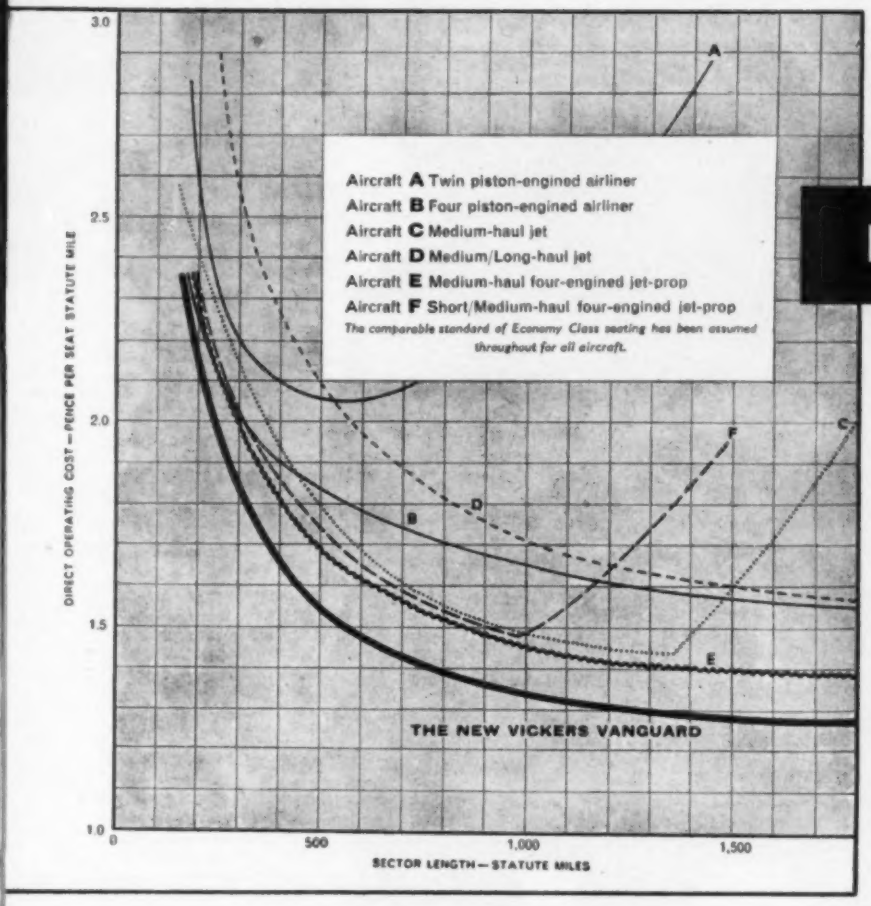
THIS year's annual meeting of the International Union of Aviation Insurers has just been completed at Garmisch-Partenkirchen. No specific resolutions were passed, but it emerged as a fairly general view that premiums on the turbojets are likely to be higher than on piston or turboprop aircraft. Three factors contributed particularly to this view: first, the high speed of the jets will allow less time for pilots to respond in moments of emergency; second, traffic control problems will be increased by the high cruising speeds and rates of climb exhibited by the turbojets; third, the large capacity of the big U.S. jets.

The productivity of the large turbojets (about 7,000 c.t.m.s per hour as against 2,000 for the latest piston types) is such that higher insurance rates might not necessarily result in higher operating costs.

The conference also discussed the insurance of atom-powered aircraft; and although the general feeling was that these aircraft would not be unusually liable to crash, a closer examination of the risks involved was prevented by the impossibility of predicting when such machines would start airline operations.

LOWER FARES





yet

MORE PROFIT

The success of economy class on the North Atlantic air routes (60% of all North Atlantic passengers now travel at economy fares) has proved the passenger attraction of the cheap rate ticket.

On short and medium-haul such traffic-boosting fare reductions can be made possible by one aircraft and one aircraft only — the Vickers Vanguard.

In economy class the Vanguard has over 50% greater profit potential than any competitive air liner and has, by a substantial margin, the lowest seat-mile cost on offer today.

What fare cuts are possible?

At 65% passenger load factor the new Vanguard, in its 139-seater economy layout, can operate at 10% clear net profit with fares ranging from 29-50% below current tourist rates. In calculating these figures actual routes, current fares and current costs have been used.

Only the VANGUARD has all these features

425 m.p.h. cruising · Seat-mile cost as low as one cent per seat-mile · Freight capacity 10 tons at normal densities · Full routeing and A.T.C. flexibility · Can use normal existing airfields · Quick turn-round · No airfield noise problems · Quiet, smooth flight · Ten years' unique Vickers/Rolls-Royce jet-prop experience.

PROFIT with the NEW

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE JET-PROP ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

TGA AT599

. . . so I looked her straight in the eye and said:

The **BP Aviation Service** reports that the addition of 0.5% by volume of BP 49 to turbine fuel containing up to 0.27% volume of water will prevent icing of the filter even at temperatures as low as −35°C.

Pretty chilly, old man!

AVIATION BP SERVICE

serves aviation well

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CIVIL AVIATION . . .

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—AND THE U.K. ACCIDENT RECORD

UNHAPPILY, the number of accidents to British civil transport aircraft during the past twelve months has given cause for much concern. Since September 1957 British operators and their insurers have had to investigate the circumstances of no fewer than 12 major British civil aircraft accidents, though not all involved loss of life.

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The table in col. 2 provides the relevant statistics for 1956 and for two previous five-year periods. It will be noted that few of the statistical measures listed indicate any improvement in British safety standards during the two five-year periods. Indeed, the most commonly used statistic—number of passengers lost per 100 million passenger miles—was in 1956 double that recorded in 1955. The figure for 1955 was 0.7 and that for 1956 was 1.4. A preliminary *Flight* estimate for 1957 indicates a figure of between 2.3 and 2.4—a considerable increase on the 1956 figure. By comparison, the equivalent fatality rate for U.S. domestic and international carriers in 1957 was 0.22—one tenth of the British rate.

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Parameter	1953	1956	1951-55	1952-56
Stage-flights flown per fatal accident	95,400	219,800	116,800	113,200
Stage-flights flown per accident involving death or serious injury	63,600	73,300	102,200	82,300
Aircraft miles flown per fatal accident	32,290,500	78,027,000	41,217,100	39,558,000
Aircraft miles flown per accident involving death or serious injury	21,527,000	26,009,000	36,065,000	28,769,500
Passengers carried per passenger killed	230,300	118,900	68,200	68,300
Passengers carried per passenger killed or seriously injured	142,600	93,200	61,900	60,500
Passenger-miles flown per passenger killed	138,569,800	72,550,000	44,625,500	43,254,000
Passenger-miles flown per passenger killed or seriously injured	85,781,300	56,863,600	40,522,000	38,334,200
Fatal accidents per 10,000 stage-flights	0.11	0.05	0.09	0.09
Fatal accidents per 1,000,000 aircraft miles	0.03	0.01	0.02	0.03
Passengers killed per 100,000,000 passenger miles	**0.7**	**1.4**	**2.2**	**2.3**

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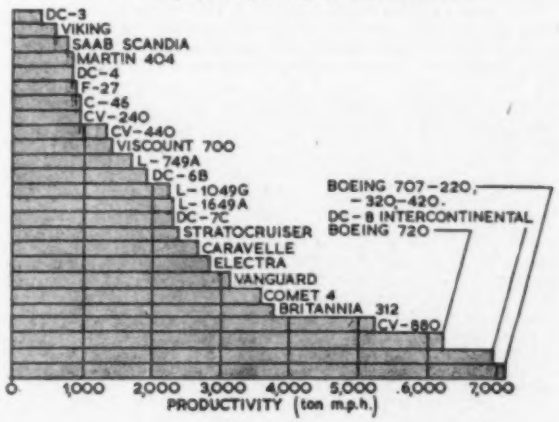

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A TEST FOR CONTINENTAL'S VISCOUNTS

THE last six months have been an expensive time for Continental Air Lines. While most of the domestic trunk carriers have been reporting reduced profits, Continental's shareholders have been told that the loss in the first half of this year amounted to $\$\frac{1}{2}$m. This figure is a measure of the cost of providing too much capacity, of embarking on new routes and of acquiring new aircraft.

Excess capacity is shown by a fall in average load-factor over the period to 50 per cent (52 per cent in the first quarter, 48 in the second), a traffic increase of 18 per cent being outstripped by an increase in capacity of 30 per cent. Such excess could hardly have been avoided if highly competitive new markets were to be

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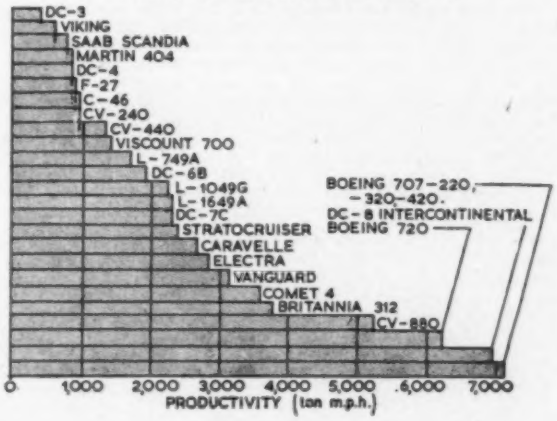

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CIVIL AVIATION . . .

entered at a time of widespread economic recession. The new aircraft were the recently acquired fleet of 15 Viscount 812s.

In the second half of the year, capacity will increase even more rapidly as the Viscounts come into full operation and as new routes are opened in New Mexico and Texas. The airline's president, Mr. Robert Six, is hoping that the C.A.B. will assist in filling this capacity by consenting to the introduction of "economy-class" fares on Chicago - Los Angeles services.

MASEFIELD ON THE DIFFERENTIAL

IN a long letter to *The Times* of September 15, commenting on an article in that newspaper, Mr. Peter Masefield, managing director of Bristol Aircraft, says: "Clearly this [the fare differential] is one of the most important issues which has faced the air transport industry of the world in recent years." He submits that the lowering of propeller-airliner fares would increase revenue "out of proportion to the reduction in the rates." At the same time, Mr. Masefield believes, there is evidence to suggest that the new, large jets will require increased fares to break even. He quotes the president of Braniff, Mr. Charles Beard (as reported in *Aviation Daily*):—

"We have found from our studies that a premium is required to provide a reasonable area for profitable operations with the jets but the time saved by passengers because of the much faster jet flights is worth the extra charge."

A further quotation is given by Mr. Masefield, again from a Braniff executive (Mr. Louis Person, traffic director) in a letter to the C.A.B.:—

"The cost per available seat-mile for the Boeing 707 with a seating configuration, which for competitive reasons we will have to operate, is approximately 19 per cent greater than for a DC-6 and approximately 30 per cent greater than for a DC-7C. For the purpose of determining . . . matters coming up for consideration at the I.A.T.A. Conference in Cannes we advise the Civil Aeronautics Board that we would require a surcharge for jet aircraft on our international operations. At the same time we presented a detailed comparative cost analysis of the DC-6 versus the Boeing 707 justifying our request for this surcharge. We believe that it is necessary for the board to act upon this matter with the greatest possible speed in order that our position, both domestic and international, will not be prejudiced."

Mr. Masefield goes on to say that "in the interests of the travelling public there appears to be a strong case for a differential fare which will afford a choice of higher speeds at higher fares or lower speeds at reduced costs."

Another contributor to the discussion is Mr. Stephen Wheatcroft, economic adviser to B.E.A. In a strong letter to the anti-differential *Economist* (September 13 issue) he writes: "It is against the increasing capital-costliness of the airline business that . . . a fare differential is aimed." Above all, he suggests, the jet differential would turn design away from its "exclusive preoccupation" with performance towards design for low cost.

ELECTRA DEMONSTRATION

MORE details are now available concerning the Lockheed Electra demonstration tour to be made in October in Europe and the Middle East. The provisional plan is for the fourth completed aircraft (about ten are now flying) to arrive in Amsterdam on October 8 and then continue to New Delhi via Brussels, Copenhagen, Oslo, Stockholm, Cologne, Zurich, Vienna, Istanbul and Teheran. The return journey will be through Bombay, Athens, Rome, Paris, London, Wiesbaden, Dublin, Keflavik and Argentina. The whole tour should take about six weeks. The area covered by it includes only one airline that has already ordered Electras—K.L.M.

CANADIAN NEWCOMER

THE latest monthly statistics produced by the Canadian Department of Transport provide information on a new scheduled carrier—Austin Airways. This airline operates regularly in Northern Ontario and Quebec on a route linking Kapuskasing - Timmins - Rouyn. Until last winter this route was

Favourably commented on at the S.B.A.C. Display was Kelvin Hughes' equipment designed to photograph and project enlargements of radar pictures. Seen here is the equipment in action: six seconds behind the cathode ray tube presentation is projected this large, clear picture of traffic around London. Note the super-imposition of the airways.

B.O.A.C. have designed the new form of passenger ticket and baggage check seen here. On the same principle as a cheque book, it can be folded in half for easy pocketing.

part of T.C.A.'s network, but when Viscounts started taking over from DC-3s on many of the shorter sectors it was found necessary to abandon the Timmins - Kapuskasing service. Shortly afterwards a Class I (scheduled) licence was awarded to Austin to take over and extend the operation.

Austin is, however, no newcomer to the air transport business, having been founded as far back as 1934 under the name Capreol and Austin Air Services. Until recently the company concentrated on charter services in the Hudson Bay area, providing air communications to the isolated trading stations, mines and tourist lodges in Ontario, north-east Manitoba and north-west Quebec.

In the last two or three years Austin Airways' activities were expanded as a result of the mining boom and of the Mid-Canada Line construction programme. In common with most other Canadian independent operators, Austin have suffered from a fall in the volume of northern charters and so are fortunate to have gained access to the scheduled market.

RE-EQUIPMENT RATIONALIZED

AUSTRALIA'S two major domestic airlines, T.A.A. and Ansett-A.N.A., were last week given the final Cabinet approval to place contracts for 28 new airliners with three manufacturers. The aircraft involved are four Electras (T.A.A. 2, Ansett 2), six Viscount 810s (T.A.A. 2, Ansett 4) and 18 Fokker Friendships (T.A.A. 12, Ansett 6). The two V.810s for T.A.A. represent a previously unannounced order, and will bring their Viscount purchases up to 14.

As part of the "co-ordination" scheme agreed between T.A.A., Ansett-A.N.A. and the Government, each airline's re-equipment costs will be guaranteed to the tune of £A8m (£6.4m).

QANTAS PROFITS DOWN

A FEW days after New Zealand National Airways announced that their net profit in 1957-58 had trebled from £21,656 to £67,136, the chairman of Qantas, Sir Hudson Fysh, revealed that his company's profits in 1957 had fallen by a third.

Although Q.E.A.'s revenue rose by 8 per cent to a record £A21.4m (£17.7m), net profits were reduced from £A484,477 to £A344,039. Two factors in particular contributed to a revenue shortfall of at least £A1m: the pilots' dispute in April which led to the suspension of operations for nine days, and the forced diversion of flights on London services because of the Suez crisis in the early months of the year. Although expenditure rose more rapidly than revenue (by 10 per cent), the unit cost fell slightly to 40 pence per c.t.m.

EMIGRANTS TO CANADA

IN these pages last week there appeared a brief analysis showing the distribution of Europe - U.S. air traffic among the 13 I.A.T.A. members participating on this route. This year's trends for Europe - Canada traffic are sufficiently different to deserve separate study.

The most significant development is that traffic moving to and from Canada has expanded much less rapidly than U.S. traffic. A simple but accurate yardstick is the historical fact that almost exactly one-half of eastbound traffic for the whole year moves in the first six months (this does not apply to westbound traffic, most of which moves in the second half of the year). If this rule continues to apply this year, then total eastbound traffic to Europe from the U.S. should increase by 29 per cent while that from Canada should show an increase of only 16 per cent.

Another significant feature of Canadian operations in the first half of the year is that, unlike U.S. traffic, the eastbound movement is exceeded by that moving westbound. This suggests that although

immigrant traffic has fallen away in the case of the U.S., it has continued to flow unabated in the case of Canada.

One of the advantages to airlines of this immigrant business is that westbound load-factors are easier to maintain in the first half of the year. Whereas the average load-factor on all westbound services to the U.S. over the first six months of this year was as low as 50 per cent, on services to Canada it stood as high as 70 per cent. T.C.A., K.L.M. and C.P.A.L. have each obtained a larger share in Europe - Canada traffic this year, apparently at the expense of B.O.A.C. Last year the Corporation carried 30 per cent of all traffic moving between Europe and Canada; this year the proportion has sunk to 22 per cent.

NO SIGNS OF IMPROVEMENT

BRITISH airport statistics for last June have been affected by the fact that, unlike that of last year, the Whitsun holiday took place in May. But this alone does not explain a drop in passenger traffic of 4 per cent.

Passenger traffic at London's airports was virtually unchanged, with falls at L.A.P., Blackbushe and Croydon being almost exactly balanced by the growth of Gatwick. The general picture throughout the rest of the country was one of traffic reduction. Excluding the London area, the average fall in the number of passengers handled at U.K. airports was 8 per cent, while in the case of the Channel Islands the figure was as much as 17 per cent.

As in earlier months this year, the West Country appears to have been less affected than areas in the North. But not all airports have been handling fewer passengers. Traffic at Ferryfield and Southend increased particularly rapidly (by 14 and 34 per cent respectively). Two other airports enjoyed an expansion, traffic rising at Manchester by 7 per cent and at Newcastle by 31 per cent. The most severe reductions were felt at the Isle of Man (31 per cent) and Prestwick (21 per cent).

Freight traffic increased everywhere with the exception of the Channel Isles. The overall increase in the U.K. was 29 per cent, with particularly heavy increases being felt at Ferryfield (31 per cent) and Southend (49 per cent).

The volume of mail traffic was substantially unchanged.

BREVITIES

TRANS-AUSTRALIA-AIRLINES confirm the purchase of two Viscount 816s, delivery to take place early next year. The Viscount order-book now stands at 402.

* * *

Four B.O.A.C. Stratocruisers have now been delivered to the Babb Co., in New York.

* * *

Scottish Airlines' two remaining Yorks have recently been sold to Skyways, Ltd.

* * *

Khartoum civil airport was re-opened on September 5 following extension and strengthening of the main runways.

* * *

The annual general meeting of the Institut du Transport Aerien (I.T.A.) will be held on Tuesday, October 14, in Paris.

* * *

T.W.A. international passenger traffic in August was 14 per cent higher than in August 1957: the airline's domestic traffic showed an increase of 2 per cent.

* * *

Northeast Airlines were involved in a labour dispute on September 6 regarding the provision of special tools needed to maintain Viscounts.

* * *

The C.A.B. has circulated to I.A.T.A. a statement expressing opposition to an increase in existing transatlantic and trans-Pacific fares.

Chairman of the I.A.T.A. Traffic Conference opening next Tuesday, September 23, will be Mr. P. C. Lawton, commercial and sales director of B.E.A. The conference is expected to last until mid-October.

* * *

Mr. James Carmichael, former president of Capital Airlines, has been appointed a vice-president of the Fairchild Engine and Airplane Corp. and will take charge of their recently formed commercial transport division.

* * *

The de Havilland Aircraft Company confirm that Ghana Airways have signed a contract for two Heron 2s. Delivery will be made at the end of the year. The aircraft will be operated as 14-seaters.

* * *

An Indian Court of Inquiry investigating an accident involving an Airwork Hermes and an I.A.C. DC-3 at Calcutta on September 1, 1957, has concluded that the Hermes pilot neglected to take due care, by rejecting the use of radar assistance while landing in poor weather.

* * *

B.E.A. announces that the overhaul life of the Dart 506 engine, as fitted to the Viscount 701 fleet, has been increased by the Air Registration Board to 2,000 hr. This is the highest engine overhaul life ever approved by the A.R.B., and one of the highest in world airline service.

* * *

American Airlines have put back their date for the inauguration of transcontinental Boeing 707 services from November this year to "early January." First service is scheduled non-stop between New York and Los Angeles; "soon afterwards" services will be extended to Chicago and San Francisco, followed by Washington, Baltimore, Dallas and Boston.

* * *

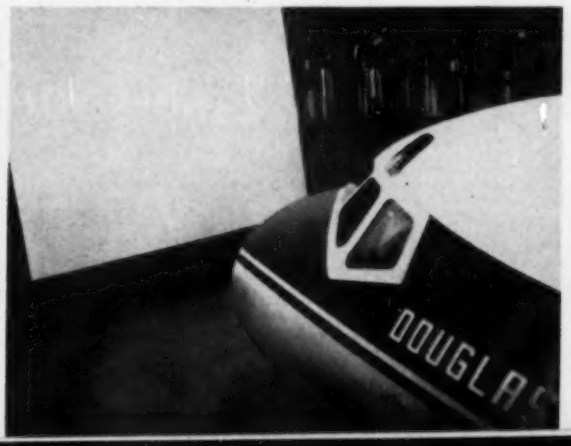
B.E.A.'s freight traffic, which did not show as good a rate of increase in 1957-58 as in 1956-57, is at the moment growing encouragingly, writes Lord Douglas in the *B.E.A. Magazine*. For the first four months of the 1958-59 financial year ton-miles went up 13 per cent. The chairman notes that last year seven per cent more freight was carried by B.E.A. in the winter than in the summer months, thus helping to mitigate the Corporation's seasonal passenger peak problems.

THE 707 COMES TO LONDON (contd. from p. 480)

public relations, was something about which PanAm would not talk last week. Asked how many 707 proving flights the airline would undertake, and how many 707 hours the new jet captains would have, Mr. Gray declined to comment. There is no doubt that, in the five weeks left to go before services begin, PanAm's crews have a great deal of work to do. It is known that a number of PanAm crews have had a B-47 conversion course with the U.S.A.F.; but PanAm know—as B.O.A.C. do—that the conversion of even the most experienced piston-airliner crews to jet operations is not a process which can be hurried. When B.O.A.C.'s Comet 4 services begin, captains will have had eight to ten hours Comet 4 conversion-flying; a minimum of 50 hr Comet 4 transatlantic and New York-local route-flying; 600-1,000 hr Comet 2E flying (120 hr of which will have been in the course of eight transatlantic Comet 2E round-trips per pilot); and 500-1,000 hr on Comet 1s. Thus each B.O.A.C. jet pilot will have had a minimum of about 1,200 hr Comet flying time, including about 170 hr transatlantic time, before he carries passengers.

Notwithstanding all their problems, PanAm announced last Monday that a *daily* transatlantic 707 service will be inaugurated between New York, Paris and Rome on October 26. (Neither Paris nor Rome imposes any noise limitations.) Services to London—also daily—will be inaugurated on November 16. When this respected American airline decides on such a quick programme one cannot afford to doubt that it will be achieved. J. M. R.

On the left is the DC-8 simulator now in use by United Air Lines at their Denver training centre. On the right is an external view of Douglas' own DC-8 simulator at Santa Monica, showing the screen on which a projected television image shows the pilot his position and attitude in relation to an airport during take-offs and landings. Full simulation of instruments and sound is provided also.



THE AIRLINES' SHOPPING LIST—No. 5

(Correct to September 12, 1958, excluding options, but including certain government and executive orders)

SINCE *Flight's* Shopping List was last published (April 18, 1958), the market has been lively. A total of 153 new turbine transports has been ordered since that date. Of these 106 were jets and 47 were turboprops. The only aircraft for which no new firm orders were placed were all turboprops: the Handley Page Dart Herald, the Bristol Britannia, and the Vickers Vanguard.

Two new types of jet airliner now appear; these are the Airco D.H.121 and the Convair 600. For the first time since the first edition of this Shopping List was published (January 13, 1956), no piston-engined transports appear: piston-airliner production has now virtually ceased, and accordingly orders for the DC-7C, L.1649A and the Convair 440 have been transferred to *Flight's* Airliner Census, a revised edition of which will appear shortly.

Notes on the market trends of individual aircraft since last April are as follows:

Boeing 707 family. Only one new order for the 320, from S.A.A.; a big order for 25 720s (i.e. 707-020) from American.

DC-8 variants. New order from Northwest (5); reports of a sale to Iberia (2).

Convair 880. An order for 25 Convair 600s—a faster, heavier development of the 880—from American.

Bristol Britannia. Cancellation of Northeast's order for five 300-series, one of which will be acquired by Air Charter. Not included in the list is an R.A.F. Transport Command order for 20 Britannia 250-series.

de Havilland Comet 4. Two new orders, one from Aerolineas Argentinas (6), one from E.A.A.C. (2).

Lockheed Electra. Four new orders, all from Australasia, increasing last April's total by 11.

Sud Caravelle. Repeat-orders from Air France (12) and S.A.S. (6), a new order from Royal Air Maroc (1).

Vickers Viscount. Order-book increased from 379 to 400, not counting an unconfirmed order for two V.810s from T.A.A.

Fokker/Fairchild Friendship. Fokker's order-book up from 47 (discounting a reported Belgian Air Force order) to 58. Fairchild's order-book up from 67 to 71, with deliveries in progress since June. (Fokker's first deliveries are imminent.)

Aircraft	Variant	Powerplant	Airlines	Total
Boeing 707	120	Pratt and Whitney JT3	PanAm, 6 (current); American, 25 (operation January, 1959); Continental, 4 (May 1959); T.W.A., 15 (from early 1959); Qantas, 7 (May—September 1959); Cubana, 2 (March, June 1960).	148
	220	Pratt and Whitney JT4	Braniff, 5 (October 1959)	
	320	Pratt and Whitney JT4	PanAm, 17 (March 1959); Air France, 17 (November 1959); Sabena, 4 (December 1959); T.W.A., 18; S.A.A., 3 (from July 1960)	
	420	Rolls-Royce Conway	Lufthansa, 4 (summer 1960); Air-India, 3 (early 1960); B.O.A.C., 15 (December 1959); Varig, 3 (July 1960)	
Boeing 720	707-020	Pratt and Whitney JT3	United, 11 (April 1960); American, 25 (early 1960)	36
Douglas DC-8	Overseas or Long Range Domestic	Pratt and Whitney JT4	PanAm, 17 (December 1959); United, 18 (mid-1959); K.L.M., 8 (March 1960); Eastern, 20 (mid-1959); J.A.L., 4 (September 1960); S.A.S., 7 (March 1960); Panagra, 4 (February 1960); Panair do Brasil, 4 (1960); Delta, 6 (June 1960); Swissair, 3 (March, June, October 1960); U.A.T., 2 (March, April, May 1960); T.A.I., 2 (June 1960); Olympic, 2 (1960); Trans-Caribbean, 1; Northwest, 5	143
		Rolls-Royce Conway	T.C.A., 6 (March 1960); Alitalia, 4 (summer 1960)	
	Domestic	Pratt and Whitney JT3	United, 22 (May 1959); National, 6 (August 1959); Delta, 2 (June 1959)	
Vickers VC.10	135 seats	Rolls-Royce Conway	B.O.A.C., 35 (1963)	35
Convair 880 and 600		General Electric CJ-805	T.W.A., 30 (late 1959); Delta, 10 (1959); Transcontinental, S.A., 4; R.E.A.L., 4 (late 1959); Capital, 9 (September 1960); American (Convair 600), 25 (1961-1962)	82
Bristol Britannia	102	Proteus 705	B.O.A.C., 15	56
	250	Proteus 761	M. of S., 3	
	300 series	Proteus 761	M. of S., 1; Aeronaves de Mexico, 2; Air Charter, 1	
	310 series	Proteus 761	B.O.A.C., 18; El Al, 4; C.P.A.L., 6; Hunting-Clan, 2; Cubana, 4 (late 1958)	
de Havilland Comet	4	Rolls-Royce Avon RA.29	B.O.A.C., 19 (current); Aerolineas Argentinas, 6 (3 from February 1959, 3 from early 1960); E.A.A.C., 2 (summer 1960)	33
	4B	Rolls-Royce Avon RA.29	B.E.A., 6 (late 1959 to spring 1960)	
Vickers Vanguard	950 series	Rolls-Royce Tyne	B.E.A., 20 (March 1960); T.C.A., 20 (August 1960)	40
Lockheed Electra		Allison 501	Eastern, 40 (October 1958); American, 35 (January 1959); Braniff, 9 (May 1959); National, 23 (April 1959); K.L.M., 12 (September 1959); Western, 9 (September 1959); Allison, 9 (delivered); Garuda, 3; Pacific Southwest, 3; Cathay Pacific, 2 (June, August 1959); Aeronaves de Mexico, 3; Qantas, 4 (last quarter 1959); Ansett-A.N.A., 2 (first quarter 1959); T.A.A., 2 (first quarter 1959); T.E.A.L., 3 (last quarter 1959)	151
Airco D.H.121		Rolls-Royce RB.141	B.E.A., 24 (from late 1963)	24
Sud Caravelle		Rolls-Royce Avon RA.29	Air France 24 (early 1959 to late 1960); S.A.S., 12 (April-October 1959); Varig, 2 (June, November 1959); Finnair, 3 (February-April 1960); Air Algerie, 3 (January-March 1960); Royal Air Maroc, 1	45
Vickers Viscount	700 & 800 series	Rolls-Royce Dart	*See list below*	400
Fokker F.27 Friendship	Fokker-built	Rolls-Royce Dart	Aer Lingus, 7 (current); T.A.A., 12 (early 1959); Dutch Government, 1; R.I.V., Turin, 1; Braathens, 3; Australian Government, 2; Iranian Oil, 2; Trabajos Aereos y Enlaces (Spain), 3 (spring 1959); Philippine Air Lines, 2 (late 1959); Sabena, 12; Aviaco, 6 (May-November 1959); Ansett-A.N.A., 6 (summer 1959); Horten (Germany), 1	58
	Fairchild-built		West Coast Air Lines, 6 (current); Mackey, 2 (current); Bonanza, 6; Piedmont, 8 (current); Quebecair, 2; U.S. executive versions, 13; Aerovias Ecuatorianas, 1 (November 1958); Northern Consolidated, 3 (October 1958-April 1959); Wheeler Airlines (Quebec), 2 (February-March 1959); Avensa, 5 (January 1959); Wien Alaska, 3 (February-April 1959); L.A.V., Venezuela, 6; Pacific Airlines, 6; Lloyd Aero Boliviano, 3 (summer 1959); Cubana, 4; Trans Mar de Cortes, 1	71

VISCOUNT ORDERS

Vickers-Armstrongs Viscount (all models). The following list of confirmed orders accounts for 400 aircraft, as follows: B.E.A., 27 V.701 (Dart 506); 24 V.802 (Dart 510), 19 V.806 (Dart 520); B.W.I.A., 4 V.702 (Dart 506), 4 V.772; Aer Lingus, 4 V.707 (Dart 506), 6 V.808 (Dart 510); Air France, 12 V.708 (Dart 506); T.A.A., 7 V.720 (Dart 505/6), 7 V.756 (Dart 510); Indian Air Force, 1 V.723 (Dart 506), 1 V.730 (Dart 506); T.C.A., 15 V.724 (Dart 506); 36 V.757 (Dart 506); Hunting-Clan, 3 V.732 and 2 V.759*; and 3 V.833; Pakistan Government, 1 V.734 (Dart 506); Iraqi Airways, 3 V.735 (Dart 506), 1 V.773 (Dart 506); Fred Olsen, 4 V.779 (Dart 510)**; Canadian Government, 1 V.737 (Dart 506), 1 V.745 (Dart 510); Misrair, 5 V.739 (Dart 506); Capital, 3 V.744 (Dart 506), 60 V.745 (Dart 510); Butler Air Transport, 2 V.747 (Dart 506); Central African Airways, 5 V.748 (Dart 510); L.A.V., 3 V.749 (Dart 506); M.E.A., 7 V.754 (Dart 510); Hong Kong, 2 V.760 (Dart 510); U.B.A., 3 V.761 (Dart 510); Hughes Tool Co., 1 V.763 (Dart 510); U.S. Steel Corp., 3 V.764 (Dart 510); Standard Oil, 1 V.765 (Dart 510); Indian Airlines, 10 V.768 (Dart 510); K.L.M., 9 V.803 (Dart 510); Transair, 3 V.804 (Dart 510); New Zealand N.A.C., 3 V.807 (Dart 510); Continental, 15 V.812 (Dart 525); South African Airways, 7 V.813 (Dart 525); Iranian Government, 3 V.782 (Dart 510); Lufthansa, 9 V.814 (Dart 525); Philippine Air Lines, 2 V.784 (Dart 510)†; Alitalia-L.A.I., 10 V.785 (Dart 510); South African Government, 1 V.781 (Dart 510); Pakistan Air Lines, 3 V.815 (Dart 525); Cubana, 3 V.755 (Dart 510), 4 V.818 (Dart 525); Lanica, 2 V.786 (Dart 510); Kaysam Investment Corp., 1 V.786 (Dart 510); Brazilian Government, 1 V.742, 1 V.789 (Dart 510); P.L.U.N.A., 3 V.769 (Dart 510); Niarchos, 1 V.819 (Dart 525); Eagle Aviation, 2 V.805; Turkish Airlines, 5 V.794; V.A.S.P., 5 V.827; Airwork, 2 V.736, 2 V.831; Ansett-A.N.A., 4 V.832 (Dart 525); Northeast, 9 V.745 (Dart 510); Kuwait Oil, 1 V.745.

* The 759s sold to Icelandair. ** Leased to Austrian Airlines. † One leased to T.A.C.A.

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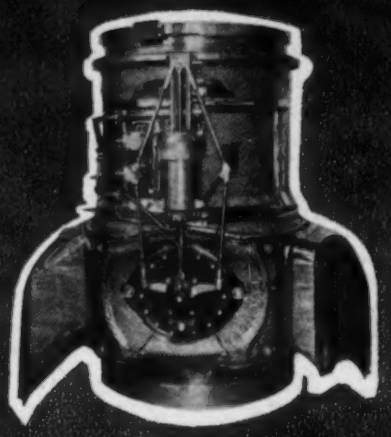

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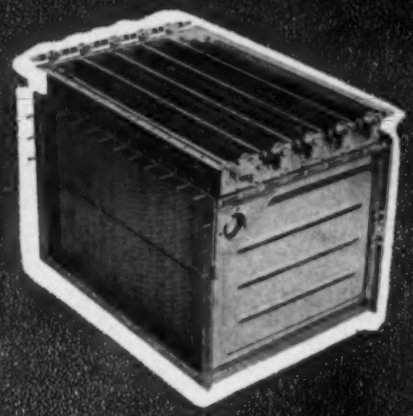

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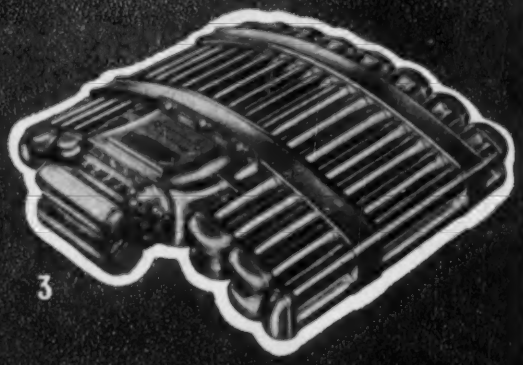

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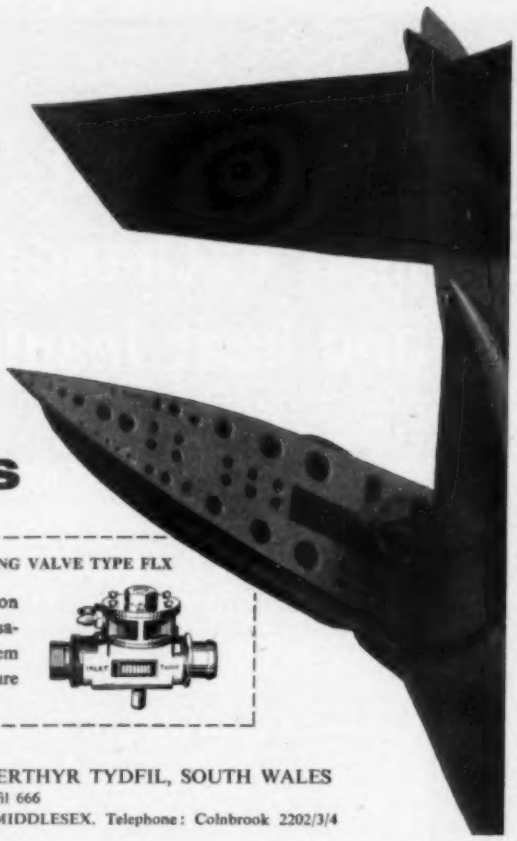

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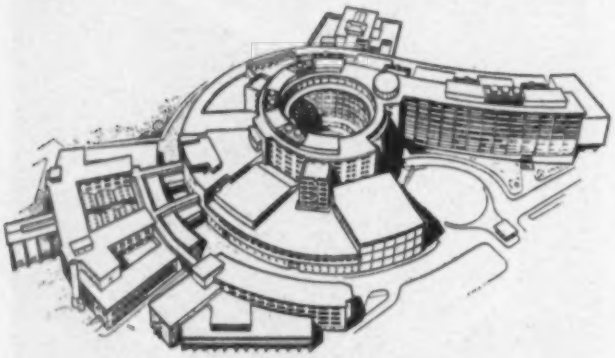

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THIS application will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to this application must be made in writing, stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [8335

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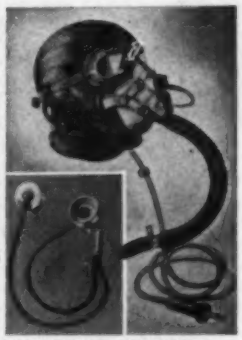

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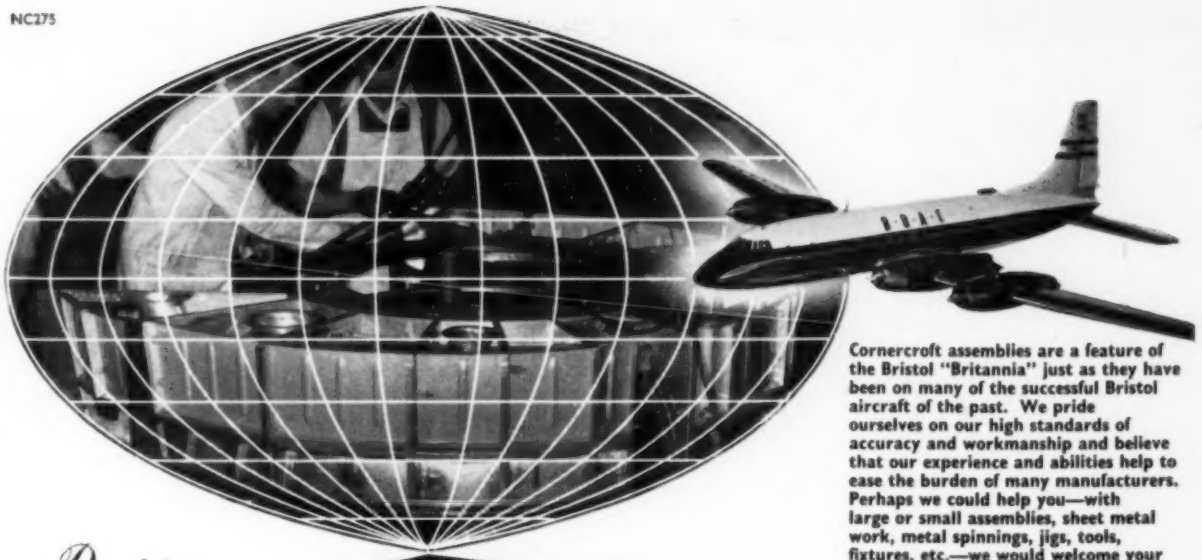

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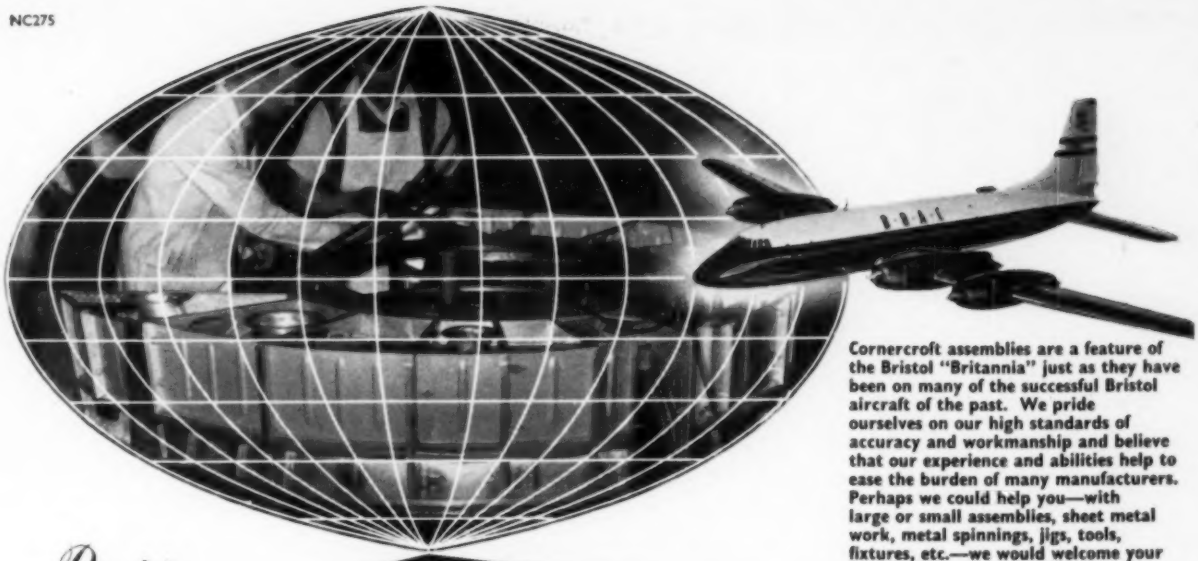

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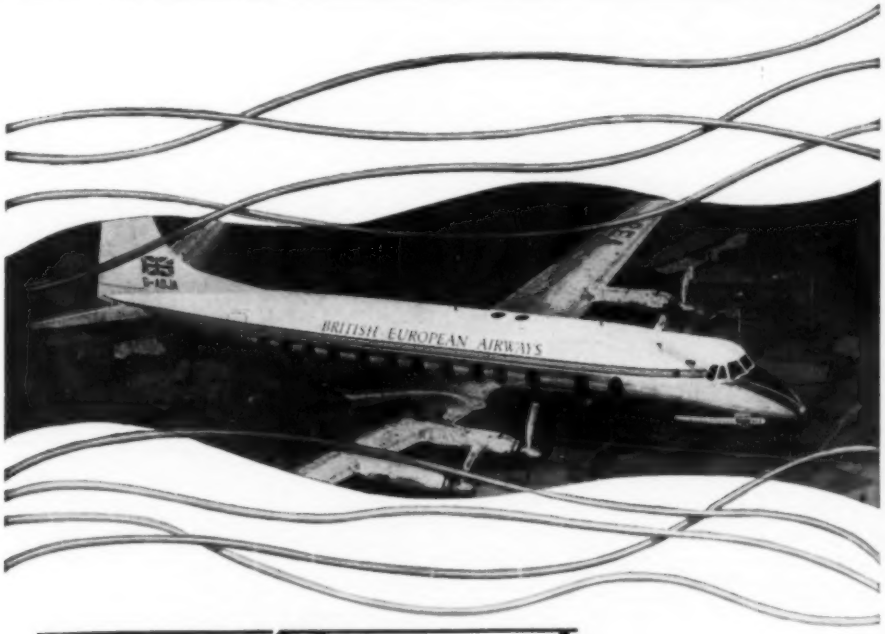

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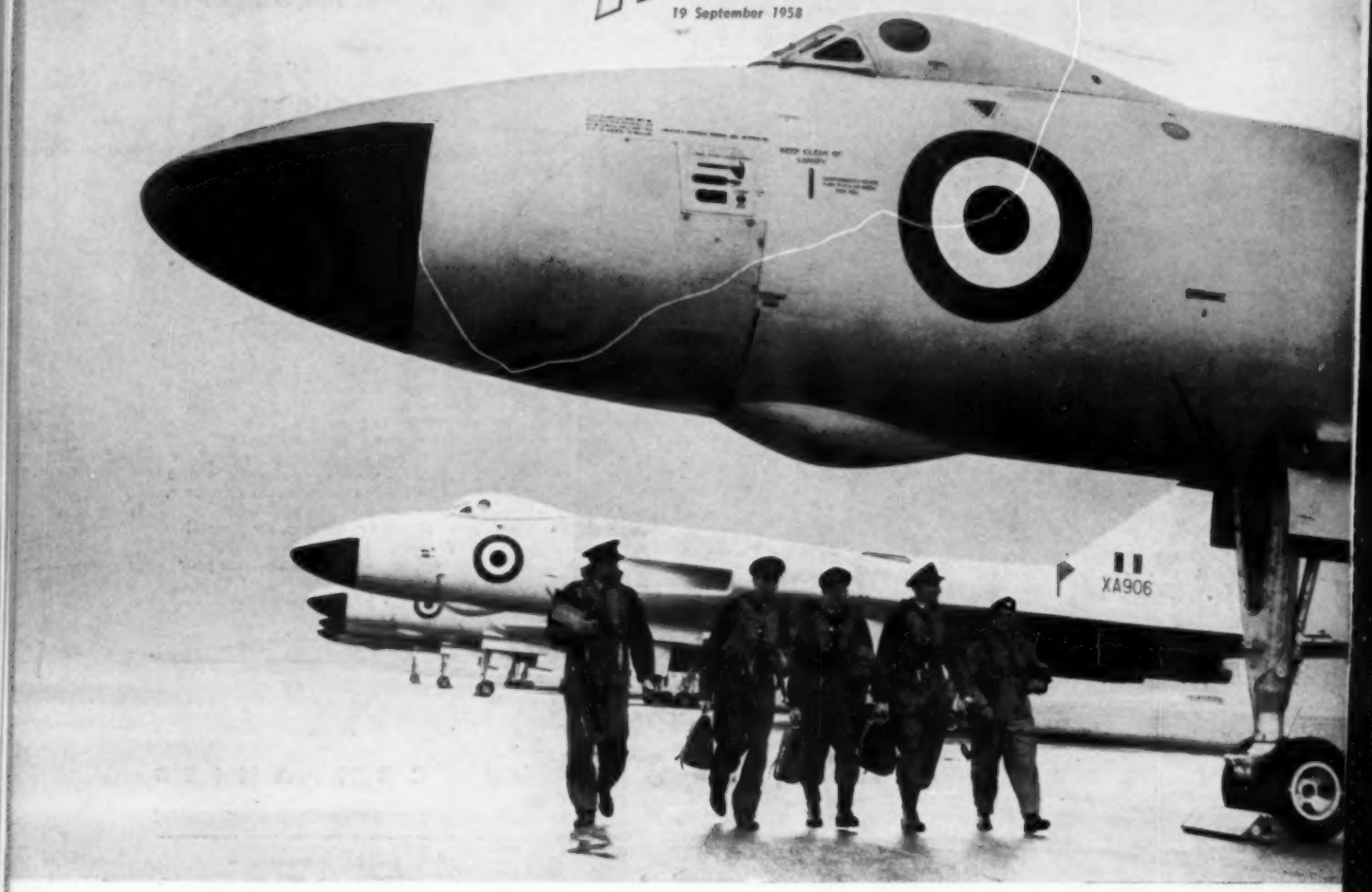

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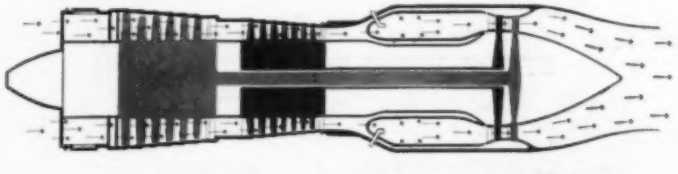

Gas-flow diagram of Bristol Olympus, illustrating twin-spool principle: low-pressure system in grey, high-pressure system in black.

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